Summary of Product Characteristics

1 NAME OF THE MEDICINAL PRODUCT

Lenvatinib Viatris 10 mg hard capsules

2 QUALITATIVE AND QUANTITATIVE COMPOSITION

Lenvatinib Viatris 10 mg hard capsules

Each hard capsule contains lenvatinib besilate equivalent to 10 mg lenvatinib.

For the full list of excipients, see section 6.1.

3 PHARMACEUTICAL FORM

Hard capsule (capsule).

Lenvatinib Viatris 10 mg hard capsules

Hard capsules size 4 (approximately 14.3 mm) with rich yellow opaque body and caramel opaque cap, printed with ''L7VB'' over ''10''.

4 CLINICAL PARTICULARS

4.1 Therapeutic indications

Differentiated Thyroid Carcinoma (DTC)

Lenvatinib Viatris as monotherapy is indicated for the treatment of adult patients with progressive, locally advanced or metastatic, differentiated (papillary/follicular/Hürthle cell) thyroid carcinoma (DTC), refractory to radioactive iodine (RAI).

Hepatocellular Carcinoma (HCC)

Lenvatinib Viatris as monotherapy is indicated for the treatment of adult patients with advanced or unresectable hepatocellular carcinoma (HCC) who have received no prior systemic therapy (see section 5.1).

Endometrial Carcinoma (EC)

Lenvatinib Viatris in combination with pembrolizumab is indicated for the treatment of adult patients with advanced or recurrent endometrial carcinoma (EC) who have disease progression on or following prior treatment with a platinum-containing therapy in any setting and are not candidates for curative surgery or radiation.

4.2 Posology and method of administration

Lenvatinib Viatris treatment should be initiated and supervised by a healthcare professional experienced in the use of anticancer therapies.

Optimal medical management (i.e., treatment or therapy) for nausea, vomiting, and diarrhoea should be initiated prior to any lenvatinib therapy interruption or dose reduction; gastrointestinal toxicity should be actively treated in order to reduce the risk of development of renal impairment or failure (see section 4.4).

Posology

If a patient misses a dose, and it cannot be taken within 12 hours, then that dose should be skipped and the next dose should be taken at the usual time of administration.
Treatment should continue as long as clinical benefit is observed or until unacceptable toxicity occurs.

Differentiated thyroidcancer (DTC)

The recommended daily dose of lenvatinib is 24 mg (two 10-mg capsules and one 4-mg capsule) once daily. The daily dose is to be modified as needed according to the dose/toxicity management plan.

Dose adjustments and discontinuations for DTC

Management of adverse reactions may require dose interruption, adjustment, or discontinuation of lenvatinib therapy (see section 4.4). Mild to moderate adverse reactions (e.g., Grade 1 or 2) generally do not warrant interruption of lenvatinib, unless intolerable to the patient despite optimal management. Severe (e.g., Grade 3) or intolerable adverse reactions require interruption of lenvatinib until improvement of the reaction to Grade 0 to 1 or baseline.

For lenvatinib-related toxicities (see Table 4), upon resolution/improvement of an adverse reaction to Grade 0 to 1 or baseline, treatment should be resumed at a reduced dose of lenvatinib as suggested in Table 1.

Table 1 Dose modifications from recommended lenvatinib daily dose in DTC patients[a]

Dose level	**Daily dose**	**Number of capsules**
Recommended daily dose	24 mg orally once daily	Two 10-mg capsules plus one 4-mg capsule
First dose reduction	20 mg orally once daily	Two 10-mg capsules
Second dose reduction	14 mg orally once daily	One 10-mg capsule plus one 4-mg capsule
Third dose reduction	10 mg orally once daily [a]	One 10-mg capsule

[a.] Further dose reductions should be considered on an individual patient basis as limited data are available for doses below 10 mg.

Treatment should be discontinued in case of life-threatening reactions (e.g., Grade 4) with the exception of laboratory abnormalities judged to be non-life-threatening, in which case they should be managed as severe reactions (e.g., Grade 3).

Hepato cellular Carcinoma

The recommended daily dose of lenvatinib is 8 mg (two 4 mg capsules) once daily for patients with a body weight of < 60 kg and 12 mg (three 4 mg capsules) once daily for patients with a body weight of ≥ 60 kg. Dose adjustments are based only on toxicities observed and not on body weight changes during treatment. The daily dose is to be modified, as needed, according to the dose/toxicity management plan.

Dose adjustments and Discontinuation for HCC

Management of some adverse reactions may require dose interruption, adjustment, or discontinuation of lenvatinib therapy. Mild to moderate adverse reactions (e.g., Grade 1 or 2) generally do not warrant interruption of lenvatinib, unless intolerable to the patient despite optimal management. For lenvatinib-related toxicities, see Table 4. Details for monitoring, dose adjustment and discontinuation are provided in Table 2.

Table 2 Dose modifications from recommended lenvatinib daily dose in HCC patients

Starting Dose		**≥60 kg BW 12 mg (three 4-mg capsules orally once daily)**	**<60 kg BW 8 mg (two 4-mg capsules orally once daily)**
Persistent and Intolerable Grade 2 or Grade 3 Toxicities[a]			
Adverse Reaction	**Modification**	**Adjusted Dose [b] (≥60 kg BW)**	**Adjusted Dose [b] (<60 kg BW)**
First occurrence[c]	Interrupt until resolved to Grade 0-1	8 mg (two 4-mg	4 mg (one 4-mg capsule) orally once daily

	or baseline [d]	capsules) orally once daily	
Second occurrence (same reaction or new reaction)	Interrupt until resolved to Grade 0-1 or baseline [d]	4 mg (one 4-mg capsule) orally once daily	4 mg (one 4-mg capsule) orally every other day
Third occurrence (same reaction or new reaction)	Interrupt until resolved to Grade 0-1 or baseline [d]	4 mg (one 4-mg capsule) orally every other day	Discontinue
Life-threatening toxicities (Grade 4): Discontinue [e]			

[a.] Initiate medical management for nausea, vomiting, or diarrhoea prior to interruption or dose reduction.
[b.] Reduce dose in succession based on the previous dose level (12 mg, 8 mg, 4 mg or 4 mg every other day).
[c.] Haematologic toxicity or proteinuria: no dose adjustment required for first occurrence.
[d.] For haematologic toxicity, dosing can restart when resolved to Grade 2; proteinuria, resume when resolves to less than 2 g/24 hours.
[e.] Excluding laboratory abnormalities judged to be nonlife-threatening, which should be managed as Grade 3.

Grades are based on the National Cancer Institute (NCI) Common Terminology Criteria for Adverse Events (CTCAE).

Endometrial Carcinoma (EC)

The recommended dosage of Lenvatinib Viatris is 20 mg orally once daily, in combination with pembrolizumab either 200 mg every 3 weeks or 400 mg every 6 weeks, administered as an intravenous infusion over 30 minutes, until unacceptable toxicity or disease progression (see section 5.1).

Refer to the Summary of Product Characteristics (SmPC) for pembrolizumab for additional dosing information.

Dose adjustments and Discontinuation for EC

For lenvatinib-related toxicities see Table 4. When administering Lenvatinib Viatris in combination with pembrolizumab, interrupt, dose reduce, or discontinue Lenvatinib Viatris as appropriate (see Table 3).
Withhold or discontinue pembrolizumab in accordance with the instructions in the SmPC for pembrolizumab. No dose reductions are recommended for pembrolizumab.

Table 3 Dose modifications from recommended lenvatinib daily dose in EC patients[a]		
Starting Dose in combination with pembrolizumab		20 mg orally once daily (two 10-mg capsules)
Persistent and Intolerable Grade 2 or Grade 3 Toxicities		
Adverse Reaction	**Modification**	**Adjusted Dose**
First occurrence	Interrupt until resolved to Grade 0-1 or baseline	14 mg orally once daily (one 10-mg capsule + one 4-mg capsule)
Second occurrence (same reaction or new reaction)	Interrupt until resolved to Grade 0-1 or baseline	10 mg orally once daily (one 10-mg capsule)
Third occurrence (same reaction or new reaction)	Interrupt until resolved to Grade 0-1 or baseline	8 mg orally once daily (two 4-mg capsules)
Life-threatening toxicities (Grade 4): Discontinue[b]		

[a.] Limited data are available for doses below 8 mg.
[b.] Treatment should be discontinued in case of life-threatening reactions (e.g., Grade 4) with the exception of laboratory abnormalities judged to be non-life-threatening, in which case they should be managed as severe reactions (e.g., Grade 3).

Table 4. Adverse reactions requiring dose modification of lenvatinib

Adverse reaction	Severity	Action	Dose reduce and resume lenvatinib
Hypertension	Grade 3 (despite optimal antihypertensive therapy)	Interrupt	Resolves to Grade 0, 1 or 2. See detailed guidance in Table 5 in section 4.4.
	Grade 4	Discontinue	Do not resume.
Proteinuria	≥ 2 g / 24 hours	Interrupt	Resolves to less than 2 g / 24 hours.
Nephrotic syndrome	-------	Discontinue	Do not resume.
Renal impairment or failure	Grade 3	Interrupt	Resolves to Grade 0-1 or baseline.
	Grade 4*	Discontinue	Do not resume.
Cardiac dysfunction	Grade 3	Interrupt	Resolves to Grade 0-1 or baseline.
	Grade 4	Discontinue	Do not resume.
Posterior reversible encephalopathy syndrome (PRES)/reversible posterior leukoencephalopathy syndrome (RPLS)	Any grade	Interrupt	Consider resuming at reduced dose if resolves to Grade 0-1.
Hepatotoxicity	Grade 3	Interrupt	Resolves to Grade 0-1 or baseline.
	Grade 4*	Discontinue	Do not resume.
Arterial thromboembolisms	Any grade	Discontinue	Do not resume.
Haemorrhage	Grade 3	Interrupt	Resolves to Grade 0-1.
	Grade 4	Discontinue	Do not resume.
Gastrointestinal perforation or fistula	Grade 3	Interrupt	Resolves to Grade 0-1 or baseline.
	Grade 4	Discontinue	Do not resume.
Non-gastrointestinal fistula	Grade 4	Discontinue	Do not resume.
QT interval prolongation	>500 ms	Interrupt	Resolves to <480 ms or baseline.
Diarrhoea	Grade 3	Interrupt	Resolves to Grade 0-1 or baseline.
	Grade 4 (despite medical management)	Discontinue	Do not resume.

* Grade 4 laboratory abnormalities judged to be non-life-threatening, may be managed as severe reactions (e.g., Grade 3).

Special populations

DTC

Patients of age ≥75 years, of Asian race, with comorbidities (such as hypertension, and hepatic or renal impairment), or body weight below 60 kg appear to have reduced tolerability to lenvatinib (see section 4.8). All patients other than those with severe hepatic or renal impairment (see below) should initiate treatment at the recommended 24-mg dose, following which the dose should be further adjusted on the basis of individual tolerability.

HCC

Patients ≥75 years, of white race or female sex or those with worse baseline hepatic impairment (Child-Pugh A score of 6 compared to score of 5) appear to have reduced tolerability to lenvatinib.

HCC patients other than those with moderate and severe hepatic impairment or severe renal impairment should initiate treatment at the recommended starting dose of 8 mg (two 4-mg capsules) for body weight < 60 kg and 12 mg (three 4-mg capsules) for body weight ≥ 60 kg, following which the dose should be further adjusted on the basis of individual tolerability.

Patients with hypertension

Blood pressure should be well controlled prior to treatment with lenvatinib, and should be regularly monitored during treatment (see sections 4.4 and 4.8).

Patients with hepatic impairment

DTC

No adjustment of starting dose is required on the basis of hepatic function in patients with mild (Child- Pugh A) or moderate (Child-Pugh B) hepatic impairment. In patients with severe (Child-Pugh C) hepatic impairment, the recommended starting dose is 14 mg taken once daily. Further dose adjustments may be necessary on the basis of individual tolerability. Refer also to section 4.8.

HCC

In the patient populations enrolled in the HCC study no dose adjustments were required on the basis of hepatic function in those patients who had mild hepatic impairment (Child-Pugh A). The available very limited data are not sufficient to allow for a dosing recommendation for HCC patients with moderate hepatic impairment (Child-Pugh B). Close monitoring of overall safety is recommended in these patients (see sections 4.4 and 5.2). Lenvatinib has not been studied in patients with severe hepatic impairment (Child-Pugh C) and is not recommended for use in these patients.

EC

Limited data are available for the combination of lenvatinib with pembrolizumab in patients with hepatic impairment. No adjustment of starting dose of the combination is required on the basis of hepatic function in patients with mild (Child-Pugh A) or moderate (Child-Pugh B) hepatic impairment. In patients with severe (Child-Pugh C) hepatic impairment, the recommended starting dose of lenvatinib is 10 mg taken once daily. Please refer to the SmPC for pembrolizumab for dosing in patients with hepatic impairment. Further dose adjustments may be necessary on the basis of individual tolerability.

Patients with renal impairment

DTC

No adjustment of starting dose is required on the basis of renal function in patients with mild or moderate renal impairment. In patients with severe renal impairment, the recommended starting dose is 14 mg taken once daily. Further dose adjustments may be necessary based on individual tolerability. Patients with end-stage renal disease were not studied, therefore the use of lenvatinib in these patients is not recommended (see section 4.8).

HCC

No dose adjustments are required on the basis of renal function in patients with mild or moderate renal impairment. The available data do not allow for a dosing recommendation for patients with HCC and severe renal impairment.

EC

No adjustment of starting dose is required on the basis of renal function in patients with mild or moderate renal impairment. In patients with severe renal impairment, the recommended starting dose is 10 mg of lenvatinib taken once daily. Please refer to the SmPC for pembrolizumab for dosing in patients with renal impairment. Further dose adjustments may be necessary based on individual tolerability. Patients with end-stage renal disease have not been studied, therefore the use of lenvatinib in these patients is not recommended.

Elderly population

No adjustment of starting dose is required on the basis of age. Limited data are available on use in patients aged ≥75 years (see section 4.8).

Paediatric population

The safety and efficacy of lenvatinib in children aged 2 to <18 years have not been established. Currently available data are described in sections 4.8, 5.1, and 5.2 but no recommendation on a posology can be made. Lenvatinib should not be used in children younger than 2 years of age because of safety concerns identified in animal studies (see section 5.3).

Race

No adjustment of starting dose is required on the basis of race (see section 5.2). Limited data are available on use in patients from ethnic origins other than Caucasian or Asian (see section 4.8).

Method of administration

Lenvatinib is for oral use. The capsules should be taken at about the same time each day, with or without food (see section 5.2). Caregivers should not open the capsule, in order to avoid repeated exposure to the contents of the capsule.

Lenvatinib capsules should be swallowed whole with water.

For patients who have difficulty swallowing and cannot swallow hard capsules, other medicinal products containing lenvatinib should be used.

For use in combination with pembrolizumab, refer to the SmPC for pembrolizumab.

4.3 Contraindications

Hypersensitivity to the active substance or to any of the excipients listed in section 6.1. Breast-feeding (see section 4.6).

4.4 Special warnings and precautions for use

Hypertension

Hypertension has been reported in patients treated with lenvatinib, usually occurring early in the course of treatment (see section 4.8). Blood pressure (BP) should be well controlled prior to treatment with lenvatinib and, if patients are known to be hypertensive, they should be on a stable dose of antihypertensive therapy for at least 1 week prior to treatment with lenvatinib. Serious complications of poorly controlled hypertension, including aortic dissection, have been reported. The early detection and effective management of hypertension are important to minimise the need for lenvatinib dose interruptions and reductions. Antihypertensive agents should be started as soon as elevated BP is confirmed. BP should be monitored after 1 week of treatment with lenvatinib, then every 2 weeks for the first 2 months, and monthly thereafter. The choice of antihypertensive treatment should be individualised to the patient's clinical circumstances and follow standard medical practice. For previously normotensive subjects, monotherapy with one of the classes of antihypertensives should be started when elevated BP is observed. For those patients already on an antihypertensive medicinal product, the dose of the current agent may be increased, if appropriate, or one or more agents of a different class of antihypertensive should be added. When necessary, manage hypertension as recommended in Table 5.

Table 5 Recommended management of hypertension	
Blood Pressure (BP) level	**Recommended action**
Systolic BP ≥140 mmHg up to <160 mmHg or diastolic BP ≥90 mmHg up to <100 mmHg	Continue lenvatinib and initiate antihypertensive therapy, if not already receiving OR Continue lenvatinib and increase the dose of the current antihypertensive therapy or initiate additional antihypertensive therapy
Systolic BP ≥160 mmHg or diastolic BP ≥100 mmHg despite optimal antihypertensive therapy	1. Withhold lenvatinib 2. When systolic BP ≤150 mmHg, diastolic BP ≤95 mmHg, and patient has been on a stable dose of antihypertensive therapy for at least 48 hours,

	resume lenvatinib at a reduced dose (see section 4.2)
Life-threatening consequences (malignant hypertension, neurological deficit, or hypertensive crisis)	Urgent intervention is indicated. Discontinue lenvatinib and institute appropriate medical management.

Aneurysms and artery dissections

The use of VEGF pathway inhibitors in patients with or without hypertension may promote the formation of aneurysms and/or artery dissections. Before initiating lenvatinib, this risk should be carefully considered in patients with risk factors such as hypertension or history of aneurysm.

Proteinuria

Proteinuria has been reported in patients treated with lenvatinib, usually occurring early in the course of treatment (see section 4.8). Urine protein should be monitored regularly. If urine dipstick proteinuria ≥2+ is detected, dose interruptions, adjustments, or discontinuation may be necessary (see section 4.2). Cases of nephrotic syndrome have been reported in patients using lenvatinib. Lenvatinib should be discontinued in the event of nephrotic syndrome.

Hepatotoxicity

In DTC, liver-related adverse reactions most commonly reported in patients treated with lenvatinib included increases in alanine aminotransferase (ALT), aspartate aminotransferase (AST), and blood bilirubin. Hepatic failure and acute hepatitis (<1%; see section 4.8) have been reported in patients with DTC treated with lenvatinib. The hepatic failure cases were generally reported in patients with progressive metastatic liver metastases disease.

In HCC patients treated with lenvatinib in the REFLECT trial, liver-related adverse reactions including hepatic encephalopathy and hepatic failure (including fatal reactions) were reported at a higher frequency (see section 4.8) compared to patients treated with sorafenib. Patients with worse hepatic impairment and/or greater liver tumour burden at baseline had a higher risk of developing hepatic encephalopathy and hepatic failure. Hepatic encephalopathy also occurred more frequently in patients aged 75 years and older. Approximately half of the events of hepatic failure and one third of the events of the hepatic encephalopathy were reported in patients with disease progression.

Data in HCC patients with moderate hepatic impairment (Child-Pugh B) are very limited and there are currently no data available in HCC patients with severe hepatic impairment (Child-Pugh C). Since lenvatinib is mainly eliminated by hepatic metabolism, an increase in exposure in patients with moderate to severe hepatic impairment is expected.

In EC, liver-related adverse reactions most commonly reported in patients treated with lenvatinib and pembrolizumab included increases in alanine aminotransferase (ALT) and aspartate aminotransferase (AST). Hepatic failure and hepatitis (<1%; see section 4.8) have been reported in patients with EC treated with lenvatinib and pembrolizumab.

Close monitoring of the overall safety is recommended in patients with mild or moderate hepatic impairment (see sections 4.2 and 5.2). Liver function tests should be monitored before initiation of treatment, then every 2 weeks for the first 2 months and monthly thereafter during treatment. Patients with HCC should be monitored for worsening liver function including hepatic encephalopathy. In the case of hepatotoxicity, dose interruptions, adjustments, or discontinuation may be necessary (see section 4.2).

Renal failure and impairment

Renal impairment and renal failure have been reported in patients treated with lenvatinib (see section 4.8). The primary risk factor identified was dehydration and/or hypovolemia due to gastrointestinal toxicity. Gastrointestinal toxicity should be actively managed in order to reduce the risk of development of renal impairment or renal failure. Dose interruptions, adjustments, or discontinuation may be necessary (see section 4.2).

If patients have severe renal impairment, the initial dose of lenvatinib should be adjusted (see sections 4.2 and 5.2).

Diarrhoea

Diarrhoea has been reported frequently in patients treated with lenvatinib, usually occurring early in the course of treatment (see section 4.8). Prompt medical management of diarrhoea should be instituted in order to prevent dehydration. Lenvatinib should be discontinued in the event of persistence of Grade 4 diarrhoea despite medical management.

Cardiac dysfunction

Cardiac failure (<1%) and decreased left ventricular ejection fraction have been reported in patients treated with lenvatinib (see section 4.8). Patients should be monitored for clinical symptoms or signs of cardiac decompensation, as dose interruptions, adjustments, or discontinuation may be necessary (see section 4.2).

Posterior reversible encephalopathy syndrome (PRES) / Reversible posterior leucoencephalopathy syndrome (RPLS)

PRES, also known as RPLS, has been reported in patients treated with lenvatinib (<1%; see section 4.8). PRES is a neurological disorder which can present with headache, seizure, lethargy, confusion, altered mental function, blindness, and other visual or neurological disturbances. Mild to severe hypertension may be present. Magnetic resonance imaging is necessary to confirm the diagnosis of PRES. Appropriate measures should be taken to control blood pressure (see section 4.4). In patients with signs or symptoms of PRES, dose interruptions, adjustments, or discontinuation may be necessary (see section 4.2).

Arterial thromboembolisms

Arterial thromboembolisms (cerebrovascular accident, transient ischaemic attack, and myocardial infarction) have been reported in patients treated with lenvatinib (see section 4.8). Lenvatinib has not been studied in patients who have had an arterial thromboembolism within the previous 6 months, and therefore should be used with caution in such patients. A treatment decision should be made based upon an assessment of the individual patient's benefit/risk. Lenvatinib should be discontinued following an arterial thrombotic event.

Women of childbearing potential

Women of childbearing potential must use highly effective contraception while taking lenvatinib and for one month after stopping treatment (see section 4.6). It is currently unknown if lenvatinib increases the risk of thromboembolic events when combined with oral contraceptives.

Haemorrhage

Serious tumour related bleeds, including fatal haemorrhagic events have occurred in clinical trials and have been reported in post-marketing experience (see section 4.8). In post-marketing surveillance, serious and fatal carotid artery haemorrhages were seen more frequently in patients with anaplastic thyroid carcinoma (ATC) than in DTC or other tumour types. The degree of tumour invasion/infiltration of major blood vessels (e.g., carotid artery) should be considered because of the potential risk of severe haemorrhage associated with tumour shrinkage/necrosis following lenvatinib therapy. Some cases of bleeding have occurred secondarily to tumour shrinkage and fistula formation, e.g., tracheo-oesophageal fistulae. Cases of fatal intracranial haemorrhage have been reported in some patients with or without brain metastases. Bleeding in sites other than the brain (e.g., trachea, intra-abdominal, lung) has also been reported. One fatal case of hepatic tumour haemorrhage in a patient with HCC has been reported.

Screening for and subsequent treatment of oesophageal varices in patients with liver cirrhosis should be performed as per standard of care before starting treatment with lenvatinib

In the case of bleeding, dose interruptions, adjustments, or discontinuation may be required (see section 4.2, Table 4).

Gastrointestinal perforation and fistula formation

Gastrointestinal perforation or fistulae have been reported in patients treated with lenvatinib (see section 4.8). In most cases, gastrointestinal perforation and fistulae occurred in patients with risk factors such as prior surgery or radiotherapy. In the case of a gastrointestinal perforation or fistula, dose interruptions, adjustments, or discontinuation may be necessary (see section 4.2).

Non-gastrointestinal fistula

Patients may be at increased risk for the development of fistulae when treated with lenvatinib. Cases of fistula formation or enlargement that involve areas of the body other than stomach or intestines were observed in clinical trials and in post-marketing experience (e.g., tracheal, tracheo-oesophageal, oesophageal, cutaneous, female genital tract fistulae). In addition, pneumothorax has been reported with and without clear evidence of a bronchopleural fistula. Some reports of fistula and pneumothorax occurred in association with tumour regression or necrosis. Prior surgery and radiotherapy may be contributing risk factors. Lung metastases may also increase the risk of pneumothorax. Lenvatinib should not be started in patients with fistula to avoid worsening and lenvatinib should be permanently discontinued in patients with oesophageal or tracheobronchial tract involvement and any Grade 4 fistula (see section 4.2); limited information is available on the use of dose interruption or reduction in management of other events, but worsening was observed in some cases and caution should be taken. Lenvatinib may adversely affect the wound healing process as for other agents of the same class.

QT interval prolongation

QT/QTc interval prolongation has been reported at a higher incidence in patients treated with lenvatinib than in patients treated with placebo (see section 4.8). Electrocardiograms should be monitored at baseline and periodically during treatment in all patients with particular attention to those with congenital long QT syndrome, congestive heart failure, bradyarrhythmias, and those taking medicinal products known to prolong the QT interval, including Class Ia and III antiarrhythmics. Lenvatinib should be withheld in the event of development of QT interval prolongation >500 ms. Lenvatinib should be resumed at a reduced dose when QTc prolongation is resolved to <480 ms or baseline.

Electrolyte disturbances such as hypokalaemia, hypocalcaemia, or hypomagnesaemia increase the risk of QT prolongation; therefore, electrolyte abnormalities should be monitored and corrected in all patients before starting treatment. Electrolytes (magnesium, potassium and calcium) should be monitored periodically during treatment. Blood calcium levels should be monitored at least monthly and calcium should be replaced as necessary during lenvatinib treatment. Lenvatinib dose should be interrupted or dose adjusted as necessary depending on severity, presence of ECG changes, and persistence of hypocalcaemia.

Impairment of thyroid stimulating hormone suppression / Thyroid dysfunction

Hypothyroidism has been reported in patients treated with lenvatinib (see section 4.8). Thyroid function should be monitored before initiation of, and periodically throughout, treatment with lenvatinib. Hypothyroidism should be treated according to standard medical practice to maintain euthyroid state.

Lenvatinib impairs exogenous thyroid suppression (see section 4.8). Thyroid stimulating hormone (TSH) levels should be monitored on a regular basis and thyroid hormone administration should be adjusted to reach appropriate TSH levels, according to the patient's therapeutic target.

Wound healing complications

No formal studies of the effect of lenvatinib on wound healing have been conducted. Impaired wound healing has been reported in patients receiving lenvatinib. Temporary interruption of lenvatinib should be considered in patients undergoing major surgical procedures. There is limited clinical experience regarding the timing of reinitiation of lenvatinib following a major surgical procedure. Therefore, the decision to resume lenvatinib following a major surgical procedure should be based on clinical judgment of adequate wound healing.

Osteonecrosis of the jaw (ONJ)

Cases of ONJ have been reported in patients treated with lenvatinib. Some cases were reported in patients who had received prior or concomitant treatment with antiresorptive bone therapy, and/or other angiogenesis inhibitors, e.g. bevacizumab, TKI, mTOR inhibitors. Caution should therefore be exercised when lenvatinib is used either simultaneously or sequentially with antiresorptive therapy and/or other angiogenesis inhibitors.

Invasive dental procedures are an identified risk factor. Prior to treatment with lenvatinib, a dental examination and appropriate preventive dentistry should be considered. In patients who have previously received or are receiving intravenous bisphosphonates, invasive dental procedures should be avoided if possible (see section 4.8).

Tumour lysis syndrome (TLS)

Lenvatinib can cause TLS which can be fatal. Risk factors for TLS include but are not limited to high tumour burden, pre-existing renal impairment and dehydration. These patients should be monitored closely and treated as clinically indicated, and prophylactic hydration should be considered.

Special populations

Limited data are available for patients of ethnic origin other than Caucasian or Asian, and in patients aged ≥75 years. Lenvatinib should be used with caution in such patients, given the reduced tolerability of lenvatinib in Asian and elderly patients (see section 4.8).

There are no data on the use of lenvatinib immediately following sorafenib or other anticancer treatments and there may be a potential risk for additive toxicities unless there is an adequate washout period between treatments. The minimal washout period in clinical trials was 4 weeks.

Patients with ECOG PS ≥ 2 were excluded from clinical studies (except for thyroid carcinoma).

Sodium

This medicine contains less than 1 mmol sodium (23 mg) per capsule, that is to say essentially 'sodium-free'.

4.5 Interaction with other medicinal products and other forms of interaction

Effect of other medicinal products on lenvatinib

Chemotherapeutic agents

Concomitant administration of lenvatinib, carboplatin, and paclitaxel has no significant impact on the pharmacokinetics of any of these 3 substances.

Effect of lenvatinib on other medicinal products

A clinical drug-drug interaction (DDI) study in cancer patients showed that plasma concentrations of midazolam (a sensitive CYP3A and Pgp substrate) were not altered in the presence of lenvatinib.
No significant drug-drug interaction is therefore expected between lenvatinib and other CYP3A4/Pgp substrates.

Oral contraceptives

It is currently unknown whether lenvatinib may reduce the effectiveness of hormonal contraceptives, and therefore women using oral hormonal contraceptives should add a barrier method (see section 4.6).

4.6 Fertility, pregnancy and lactation

Women of childbearing potential

Women of childbearing potential should avoid becoming pregnant and use highly effective contraception while on treatment with lenvatinib and for at least one month after finishing treatment. It is currently unknown whether lenvatinib may reduce the effectiveness of hormonal contraceptives, and therefore women using oral hormonal contraceptives should add a barrier method.

Pregnancy

There are no data on the use of lenvatinib in pregnant women. Lenvatinib was embryotoxic and teratogenic when administered to rats and rabbits (see section 5.3).

Lenvatinib should not be used during pregnancy unless clearly necessary and after a careful consideration of the needs of the mother and the risk to the foetus.

Breast-feeding

It is not known whether lenvatinib is excreted in human milk. Lenvatinib and its metabolites are excreted in rat milk (see section 5.3).

A risk to newborns or infants cannot be excluded and, therefore, lenvatinib is contraindicated during breast-feeding (see section 4.3).

Fertility

Effects in humans are unknown. However, testicular and ovarian toxicity has been observed in rats, dogs, and monkeys (see section 5.3).

4.7 Effects on ability to drive and use machines

Lenvatinib has minor influence on the ability to drive and use machines, due to undesirable effects such as fatigue and dizziness. Patients who experience these symptoms should use caution when driving or operating machines.

4.8 Undesirable effects

Summary of the safety profile

DTC

The most frequently reported adverse reactions (occurring in ≥30% of patients) are hypertension (68.6%), diarrhoea (62.8%), decreased appetite (51.5%), decreased weight (49.1%), fatigue (45.8%), nausea (44.5%), proteinuria 36.9%), stomatitis (35.8%), vomiting (34.5%), dysphonia (34.1%), headache (34.1%), and palmar-plantar erythrodysaesthesia syndrome (PPE) (32.7%). Hypertension and proteinuria tend to occur early during lenvatinib treatment (see sections 4.4 and 4.8). The majority of Grade 3 to 4 adverse reactions occurred during the first 6 months of treatment except for diarrhoea, which occurred throughout treatment, and weight loss, which tended to be cumulative over time.

The most important serious adverse reactions were renal failure and impairment (2.4%), arterial thromboembolisms (3.9%), cardiac failure (0.7%), intracranial tumour haemorrhage (0.7%), PRES / RPLS (0.2%), hepatic failure (0.2%), and arterial thromboembolisms (cerebrovascular accident (1.1%), transient ischaemic attack (0.7%), and myocardial infarction (0.9%).

In 452 patients with RAI-refractory DTC, dose reduction and discontinuation were the actions taken for an adverse reaction in 63.1% and 19.5% of patients, respectively. Adverse reactions that most commonly led to dose reductions (in ≥5% of patients) were hypertension, proteinuria, diarrhoea, fatigue, PPE, decreased weight, and decreased appetite. Adverse reactions that most commonly led to discontinuation of lenvatinib were proteinuria, asthenia, hypertension, cerebrovascular accident, diarrhoea, and pulmonary embolism.

HCC

The most frequently reported adverse reactions (occurring in ≥30% of patients) are hypertension (44.0%), diarrhoea (38.1%), decreased appetite (34.9%), fatigue (30.6%), and decreased weight (30.4%).

The most important serious adverse reactions were hepatic failure (2.8%), hepatic encephalopathy (4.6%), oesophageal varices haemorrhage (1.4%), cerebral haemorrhage (0.6%), arterial thromboembolic events (2.0%) including myocardial infarction (0.8%), cerebral infarction (0.4%) and cerebrovascular accident (0.4%) and renal failure/impairment events (1.4%). There was a higher incidence of decreased neutrophil count in patients with HCC (8.7% on lenvatinib than in other non- HCC tumour types (1.4%)), which was not associated with infection, sepsis or bacterial peritonitis.

In 496 patients with HCC, dose modification (interruption or reduction) and discontinuation were the actions taken for an adverse reaction in 62.3% and 20.2% of patients, respectively. Adverse reactions that most commonly led to dose modifications (in ≥5% of patients) were decreased appetite, diarrhoea, proteinuria, hypertension, fatigue, PPE and decreased platelet count. Adverse reactions that most commonly led to discontinuation of lenvatinib were hepatic encephalopathy, fatigue, increased blood bilirubin, proteinuria and hepatic failure.

EC

The safety of lenvatinib in combination with pembrolizumab has been evaluated in 530 patients with advanced EC receiving 20 mg lenvatinib once daily and 200 mg pembrolizumab every 3 weeks. The most common (occurring in ≥20% of patients) adverse reactions were hypertension (63%), diarrhoea (57%), hypothyroidism (56%), nausea (51%), decreased appetite (47%), vomiting (39%), fatigue (38%), decreased weight (35%), arthralgia (33%), proteinuria (29%), constipation (27%), headache (27%), urinary tract infection (27%), dysphonia (25%), abdominal pain (23%), asthenia (23%), palmar-plantar erythrodysaesthesia syndrome (23%), stomatitis (23%), anaemia (22%), and hypomagnesaemia (20%).

The most common (occurring in ≥5% of patients) severe (Grade ≥3) adverse reactions were hypertension (37.2%), decreased weight (9.1%), diarrhoea (8.1%), increased lipase (7.7%), decreased appetite (6.4%), asthenia (6%), fatigue (6%), hypokalaemia (5.7%), anaemia (5.3%), and proteinuria (5.1%).

Discontinuation of lenvatinib occurred in 30.6% of patients, and discontinuation of both lenvatinib and pembrolizumab occurred in 15.3% of patients due to an adverse reaction. The most common (occurring in ≥1% of patients) adverse reactions leading to discontinuation of lenvatinib were hypertension (1.9%), diarrhoea (1.3%), asthenia (1.3%), decreased appetite (1.3%), proteinuria (1.3%), and decreased weight (1.1%).

Dose interruption of lenvatinib due to an adverse reaction occurred in 63.2% of patients. Dose interruption of lenvatinib and pembrolizumab due to an adverse reaction occurred in 34.3% of patients. The most common (occurring in ≥5% of patients) adverse reactions leading to interruption of lenvatinib were hypertension (12.6%), diarrhoea (11.5%), proteinuria (7.2%), vomiting (7%), fatigue (5.7%), and decreased appetite (5.7%).

Dose reduction of lenvatinib due to adverse reactions occurred in 67.0% of patients. The most common (occurring in ≥5% of patients) adverse reactions resulting in dose reduction of lenvatinib were hypertension (16.2%), diarrhoea (12.5%), palmar-plantar erythrodysaesthesia syndrome (9.1%), fatigue (8.7%), proteinuria (7.7%), decreased appetite (6.6%), nausea (5.5%), asthenia (5.1%), and decreased weight (5.1%).

Tabulated list of adverse reactions

The safety profile of lenvatinib as monotherapy is based on data from 452 DTC patients and 496 HCC patients; allowing characterisation only of common adverse drug reactions in DTC and HCC patients. The adverse reactions presented in this section are based on safety data of both DTC and HCC patients (see section 5.1).

The safety profile of lenvatinib as combination therapy is based on data from 530 EC patients treated with lenvatinib in combination with pembrolizumab (see section 5.1).

Adverse reactions observed in clinical trials in DTC, HCC, and EC, and reported from post-marketing use of lenvatinib are listed in Table 6. The adverse reaction frequency category represents the most conservative estimate of frequency from the individual populations. Adverse reactions known to occur with lenvatinib or combination therapy components given alone may occur during treatment with these medicinal products in combination, even if these reactions were not reported in clinical studies with combination therapy.

For additional safety information when lenvatinib is administered in combination, refer to the SmPC for the respective combination therapy component (pembrolizumab).

Frequencies are defined as:
- Very common (≥1/10)
- Common (≥1/100 to <1/10)
- Uncommon (≥1/1,000 to <1/100)
- Rare (≥1/10,000 to <1/1,000)
- Very rare (< 1/10,000)
- Not known (cannot be estimated from the available data)

Within each frequency category, undesirable effects are presented in order of decreasing seriousness.

Table 6 Adverse reactions reported in patients treated with lenvatinib§

System Organ Class (MedDRA terminology)	**Lenvatinib monotherapy**	**Combination with pembrolizumab**
Infections and infestations		

Very common	Urinary tract infection	Urinary tract infection
Uncommon	Perineal abscess	Perineal abscess
Blood and lymphatic disorders		
Very common	Thrombocytopenia[a,‡] Lymphopenia[a,‡] Leukopenia[a,‡] Neutropenia[a,‡]	Thrombocytopenia[a,‡] Lymphopenia[a,‡] Leukopenia[a,‡] Neutropenia[a,‡] Anaemia
Uncommon	Splenic infarction	
Endocrine disorders		
Very common	Hypothyroidism Increased blood thyroid stimulating hormone[*,‡]	Hypothyroidism Increased blood thyroid stimulating hormone[*] Hyperthyroidism
Common		Adrenal insufficiency
Uncommon	Adrenal insufficiency	
Metabolism and nutrition disorders		
Very common	Hypocalcaemia[*, ‡] Hypokalaemia[‡] Hypercholesterolaemia [b,‡] Hypomagnesaemia[b,‡] Decreased weight Decreased appetite	Hypocalcaemia[*, ‡] Hypokalaemia[‡] Hypercholesterolaemia[b, ‡] Hypomagnesaemia[b, ‡] Decreased weight Decreased appetite
Common	Dehydration	Dehydration
Rare	Tumour lysis syndrome†	Tumour lysis syndrome†
Psychiatric disorders		
Very common	Insomnia	
Common		Insomnia
Nervous system disorders		
Very common	Dizziness Headache Dysgeusia	Dizziness Headache Dysgeusia
Common	Cerebrovascular accident[†]	
Uncommon	Posterior reversible encephalopathy syndrome Monoparesis Transient ischaemic attack	Posterior reversible encephalopathy syndrome Cerebrovascular accident[†] Monoparesis Transient ischaemic attack
Cardiac disorders		
Common	Myocardial infarction[c,†] Cardiac failure Prolonged electrocardiogram QT Decreased ejection fraction	Prolonged electrocardiogram QT
Uncommon		Myocardial infarction[c,†] Cardiac failure Decreased ejection fraction
Vascular disorders		
Very common	Haemorrhage[d, *,†] Hypertension[e,*] Hypotension	Haemorrhage[d, *,†] Hypertension[e,*]
Common		Hypotension
Unknown	Aneurysms and artery dissections	
Respiratory, thoracic and mediastinal disorders		
Very common	Dysphonia	Dysphonia
Common	Pulmonary embolism[†]	Pulmonary embolism[†]

Uncommon	Pneumothorax	Pneumothorax
Gastrointestinal disorders		
Very common	Diarrhoea Gastrointestinal and abdominal pains[f] Vomiting Nausea Oral inflammation[g] Oral pain[h] Constipation Dyspepsia Dry mouth Increased lipase[‡] Increased amylase[‡]	Diarrhoea Gastrointestinal and abdominal pains[f] Vomiting Nausea Oral inflammation[g] Oral pain[h] Constipation Dry mouth Increased lipase[‡] Increased amylase[‡]
Common	Anal fistula Flatulence Gastrointestinal perforation	Pancreatitis[i] Flatulence Dyspepsia Colitis Gastrointestinal perforation
Uncommon	Pancreatitis[i] Colitis	Anal fistula
Hepatobiliary disorders		
Very common	Increased blood bilirubin[j,*,‡] Hypoalbuminaemia[j,*,‡] Increased alanine aminotransferase[*,‡] Increased aspartate aminotransferase[*,‡] Increased blood alkaline phosphatase[‡] Increased gamma-glutamyltransferase[‡]	Increased blood bilirubin[j,*,‡] Hypoalbuminaemia[j,*,‡] Increased alanine aminotransferase[*,‡] Increased aspartate aminotransferase[*,‡] Increased blood alkaline phosphatase[‡]
Common	Hepatic failure[k,*,†] Hepatic encephalopathy[l,*,†] Abnormal hepatic function Cholecystitis	Cholecystitis Abnormal hepatic function Increased gamma- glutamyltransferase
Uncommon	Hepatocellular damage/hepatitis[m]	Hepatic failure[k,*,†] Hepatic encephalopathy[l,†] Hepatocellular damage/hepatitis[m]
Skin and subcutaneous tissue disorders		
Very common	Palmar-plantar erythrodysaesthesia syndrome Rash Alopecia	Palmar-plantar erythrodysaesthesia syndrome Rash
Common	Hyperkeratosis	Alopecia
Uncommon		Hyperkeratosis
Musculoskeletal and connective tissue disorders		
Very common	Back pain Arthralgia Myalgia Pain in extremity Musculoskeletal pain	Back pain Arthralgia Myalgia Pain in extremity
Common		Musculoskeletal pain
Uncommon	Osteonecrosis of the jaw	
Renal and urinary disorders		
Very common	Proteinuria[*] Increased blood creatinine[‡]	Proteinuria[*] Increased blood creatinine[‡]
Common	Renal failure [n,*,†]	Renal failure [n,*,†]

	Renal impairment* Increased blood urea	
Uncommon	Nephrotic syndrome	Renal impairment* Increased blood urea
General disorders and administration site conditions		
Very common	Fatigue Asthenia Oedema peripheral	Fatigue Asthenia Oedema peripheral
Common	Malaise	Malaise
Uncommon	Impaired healing	Impaired healing
Not known	Non-gastrointestinal fistula[o]	

§: Adverse reaction frequencies presented in Table 6 may not be fully attributable to lenvatinib alone, but may contain contributions from the underlying disease or from other medicinal products used in a combination.
*: See section 4.8 Description of selected adverse reactions for further characterisation.
†: Includes cases with a fatal outcome.
‡: Frequency based on laboratory data.

The following terms have been combined:
a: Thrombocytopenia includes thrombocytopenia and decreased platelet count. Neutropenia includes neutropenia and decreased neutrophil count. Leukopenia includes leukopenia and decreased white blood cell count. Lymphopenia includes lymphopenia and lymphocyte count decreased.
b: Hypomagnesaemia includes hypomagnesaemia and decreased blood magnesium. Hypercholesterolaemia includes hypercholesterolaemia and increased blood cholesterol.
c: Myocardial infarction includes myocardial infarction and acute myocardial infarction. d: Includes all haemorrhage terms.
Haemorrhage terms that occurred in 5 or more subjects with DTC were: epistaxis, haemoptysis, haematuria, contusion, haematochezia, gingival bleeding, petechial, pulmonary haemorrhage, rectal haemorrhage, blood urine present, haematoma and vaginal haemorrhage.
Haemorrhage terms that occurred in 5 or more subjects with HCC were: epistaxis, haematuria, gingival bleeding, haemoptysis, oesophageal varices haemorrhage, haemorrhoidal haemorrhage, mouth haemorrhage, rectal haemorrhage and upper gastrointestinal haemorrhage.
Haemorrhage term that occurred in 5 or more subjects with EC was: vaginal haemorrhage.
e: Hypertension includes: hypertension, hypertensive crisis, increased diastolic blood pressure, orthostatic hypertension, and increased blood pressure.
f: Gastrointestinal and abdominal pains includes: abdominal discomfort, abdominal pain, abdominal pain lower, abdominal pain upper, abdominal tenderness, epigastric discomfort, and gastrointestinal pain.
g: Oral inflammation includes: aphthous stomatitis, aphthous ulcer, gingival erosion, gingival ulceration, oral mucosal blistering, stomatitis, glossitis, mouth ulceration, and mucosal inflammation.
h: Oral pain includes: oral pain, glossodynia, gingival pain, oropharyngeal discomfort, oropharyngeal pain and tongue discomfort.
i: Pancreatitis includes: pancreatitis and acute pancreatitis.
j: Increased blood bilirubin includes: hyperbilirubinaemia, increased blood bilirubin, jaundice and increased bilirubin conjugated. Hypoalbuminaemia includes hypoalbuminaemia and decreased blood albumin.
k: Hepatic failure includes: hepatic failure, acute hepatic failure and chronic hepatic failure.
l: Hepatic encephalopathy includes: hepatic encephalopathy, coma hepatic, metabolic encephalopathy and encephalopathy. m: Hepatocellular damage and hepatitis includes: drug-induced liver injury, hepatic steatosis, and cholestatic liver injury.
n: Renal failure cases includes: acute prerenal failure, renal failure, renal failure acute, acute kidney injury and renal tubular necrosis.
o: Non-gastrointestinal fistula includes cases of fistula occurring outside of the stomach and intestines such as tracheal, tracheo-oesophageal, oesophageal, female genital tract fistula, and cutaneous fistula.

Description of selectedad verse reactions

Hypertension (see section 4.4)

DTC

In the pivotal Phase 3 SELECT trial (see section 5.1), hypertension (including hypertension, hypertensive crisis, increased diastolic blood pressure, and increased blood pressure) was reported in 72.8% of lenvatinib-treated patients and 16.0% of

patients in the placebo-treated group. The median time to onset in lenvatinib-treated patients was 16 days. Reactions of Grade 3 or higher (including 1 reaction of Grade 4) occurred in 44.4% of lenvatinib-treated patients compared with 3.8% of placebo-treated patients. The majority of cases recovered or resolved following dose interruption or reduction, which occurred in 13.0% and 13.4% of patients, respectively. In 1.1% of patients, hypertension led to permanent treatment discontinuation.

HCC

In the Phase 3 REFLECT trial (see section 5.1), hypertension (including hypertension, increased blood pressure, increased diastolic blood pressure and orthostatic hypertension) was reported in 44.5% of lenvatinib-treated patients and Grade 3 hypertension occurred in 23.5%. The median time to onset was 26 days. The majority of cases recovered following dose interruption or reduction, which occurred in 3.6% and 3.4% of patients, respectively. One subject (0.2%) discontinued lenvatinib due to hypertension.

EC

In the Phase 3 Study 309 (see section 5.1), hypertension was reported in 65% of patients in the lenvatinib plus pembrolizumab group. Reactions of Grade 3 or higher occurred in 38.4% of patients in the lenvatinib plus pembrolizumab group. The median time to onset in the lenvatinib plus pembrolizumab group was 15 days. Dose interruption, reduction and discontinuation of lenvatinib occurred in 11.6%, 17.7% and 2.0% of patients, respectively.

Proteinuria (see section 4.4)

DTC

In the pivotal Phase 3 SELECT trial (see section 5.1), proteinuria was reported in 33.7% of lenvatinib- treated patients and 3.1% of patients in the placebo-treated group. The median time to onset was 6.7 weeks. Grade 3 reactions occurred in 10.7% of lenvatinib-treated patients and none in placebo-treated patients. The majority of cases had an outcome of recovered or resolved following dose interruption or reduction, which occurred in 16.9% and 10.7% of patients, respectively. Proteinuria led to permanent treatment discontinuation in 0.8% of patients.

HCC

In the Phase 3 REFLECT trial (see section 5.1), proteinuria was reported in 26.3% of lenvatinib-treated patients and Grade 3 reactions occurred in 5.9%. The median time to onset was 6.1 weeks. The majority of cases recovered following dose interruption or reduction, which occurred in 6.9% and 2.5% of patients, respectively. Proteinuria led to permanent treatment discontinuation in 0.6% of patients.

EC

In the Phase 3 Study 309 (see section 5.1), proteinuria was reported in 29.6% of lenvatinib plus pembrolizumab-treated patients and Grade ≥3 reactions occurred in 5.4% of patients. The median time to onset was 34.5 days. Dose interruption, reduction and discontinuation of lenvatinib occurred in 6.2%, 7.9% and 1.2% of patients, respectively.

Renal failure and impairment (see section 4.4)

DTC

In the pivotal Phase 3 SELECT trial (see section 5.1), 5.0% of patients developed renal failure and 1.9% developed renal impairment (3.1% of patients had a Grade ≥ 3 event of renal failure or impairment). In the placebo group 0.8% of patients developed renal failure or impairment (0.8% were Grade ≥ 3).

HCC

In the Phase 3 REFLECT trial (see section 5.1), 7.1% of lenvatinib-treated patients developed a renal failure/impairment event. Grade 3 or greater reactions occurred in 1.9% of lenvatinib-treated patients.

EC

In the Phase 3 Study 309 (see section 5.1), 18.2% of lenvatinib plus pembrolizumab-treated patients developed a renal failure/impairment event. Grade ≥ 3 reactions occurred in 4.2% of patients. The median time to onset was 86.0 days. Dose interruption, reduction and discontinuation of lenvatinib occurred in 3.0%, 1.7% and 1.2% of patients, respectively.

Cardiac dysfunction (see section 4.4)

DTC

In the pivotal Phase 3 SELECT trial (see section 5.1), decreased ejection fraction/cardiac failure was reported in 6.5% of patients (1.5% were Grade ≥ 3) in the lenvatinib treated group, and 2.3% in the placebo group (none were Grade ≥ 3).

HCC

In the Phase 3 REFLECT trial (see section 5.1), cardiac dysfunction (including congestive cardiac failure, cardiogenic shock, and cardiopulmonary failure) was reported in 0.6% of patients (0.4% were Grade ≥ 3) in the lenvatinib-treated group.

EC

In the Phase 3 Study 309 (see section 5.1), cardiac dysfunction was reported in 1.0% of lenvatinib plus pembrolizumab-treated patients and Grade ≥3 reactions occurred in 0.5% of patients. The median time to onset was 112.0 days. Dose reduction and discontinuation of lenvatinib both occurred in 0.2% of patients.

Posterior reversible encephalopathy syndrome (PRES)/Reversible posterior leucoencephalopathy syndrome (RPLS) (see section 4.4)

DTC

In the pivotal Phase 3 SELECT trial (see section 5.1), there was 1 event of PRES (Grade 2) in the lenvatinib-treated group and no reports in the placebo group.

HCC

In the Phase 3 REFLECT trial (see section 5.1), there was 1 event of PRES (Grade 2) in the lenvatinib-treated group.

Amongst 1,823 patients treated with lenvatinib monotherapy in clinical trials, there were 5 cases (0.3%) of PRES (0.2% were Grade 3 or 4), all of which resolved after treatment and/or dose interruption, or permanent discontinuation.

EC

In the Phase 3 Study 309 (see section 5.1), there was one event of PRES (Grade 1) in the lenvatinib plus pembrolizumab-treated group for which lenvatinib was interrupted.

Hepatotoxicity (see section 4.4)

DTC

In the pivotal Phase 3 SELECT trial (see section 5.1), the most commonly reported liver-related adverse reactions were hypoalbuminaemia (9.6% lenvatinib vs. 1.5% placebo) and elevations of liver enzyme levels, including increases in alanine aminotransferase (7.7% lenvatinib vs. 0 placebo), aspartate aminotransferase (6.9% lenvatinib vs. 1.5% placebo), and blood bilirubin (1.9% lenvatinib vs. 0 placebo). The median time to onset of liver reactions in lenvatinib-treated patients was 12.1 weeks. Liver-related reactions of Grade 3 or higher (including 1 Grade 5 case of hepatic failure) occurred in 5.4% of lenvatinib-treated patients compared with 0.8% in placebo-treated patients. Liver-related reactions led to dose interruptions and reductions in 4.6% and 2.7% of patients, respectively, and to permanent discontinuation in 0.4%.
Amongst 1,166 patients treated with lenvatinib, there were 3 cases (0.3%) of hepatic failure, all with a fatal outcome. One occurred in a patient with no liver metastases. There was also a case of acute hepatitis in a patient without liver metastases.

HCC

In the Phase 3 REFLECT trial (see section 5.1), the most commonly reported hepatotoxicity adverse reactions were increased blood bilirubin (14.9%), increased aspartate aminotransferase (13.7%), increased alanine aminotransferase (11.1%),

hypoalbuminaemia (9.2%), hepatic encephalopathy (8.0%), increased gamma-glutamyltransferase (7.8%) and increased blood alkaline phosphatase (6.7%). The median time to onset of hepatotoxocity adverse reactions was 6.4 weeks. Hepatotoxicity reactions of ≥ Grade 3 occurred in 26.1% of lenvatinib-treated patients. Hepatic failure (including fatal events in 12 patients) occurred in 3.6% of patients (all were ≥ Grade 3). Hepatic encephalopathy (including fatal events in 4 patients) occurred in 8.4% of patients (5.5% were ≥ Grade 3). There were 17 (3.6%) deaths due to hepatotoxicity events in the lenvatinib arm and 4 (0.8%) deaths in the sorafenib arm. Hepatotoxicity adverse reactions led to dose interruptions and reductions in 12.2% and 7.4% of lenvatinib-treated patients respectively, and to permanent discontinuation in 5.5%.

Across clinical trials in which 1327 patients received lenvatinib monotherapy in indications other than HCC, hepatic failure (including fatal events) was reported in 4 patients (0.3%), liver injury in 2 patients (0.2%), acute hepatitis in 2 patients (0.2%), and hepatocellular injury in 1 patient (0.1%).

EC

In the Phase 3 Study 309 (see section 5.1), hepatotoxicity was reported in 33.7% of lenvatinib plus pembrolizumab-treated patients and Grade ≥3 reactions occurred in 12.1% of patients. The median time to onset was 56.0 days. Dose interruption, reduction and discontinuation of lenvatinib occurred in 5.2%, 3.0% and 1.2% of patients, respectively.

Arterial thromboembolisms (see section4.4)

DTC

In the pivotal Phase 3 SELECT trial (see section 5.1), arterial thromboembolic events were reported in 5.4% of lenvatinib-treated patients and 2.3% of patients in the placebo group.

HCC

In the Phase 3 REFLECT trial (see section 5.1), arterial thromboembolic events were reported in 2.3% of patients treated with lenvatinib.

Amongst 1,823 patients treated with lenvatinib monotherapy in clinical trials, there were 10 cases (0.5%) of arterial thromboembolisms (5 cases of myocardial infarction and 5 cases of cerebrovascular accident) with a fatal outcome.

EC

In the Phase 3 Study 309 (see section 5.1), arterial thromboembolisms were reported in 3.7% of lenvatinib plus pembrolizumab-treated patients and Grade ≥3 reactions occurred in 2.2% of patients. The median time to onset was 59.0 days. Dose interruption and discontinuation of lenvatinib occurred in 0.2% and 2.0% of patients, respectively.

Haemorrhage (see section 4.4)

DTC

In the pivotal Phase 3 SELECT trial (see section 5.1), haemorrhage was reported in 34.9% (1.9% were Grade ≥ 3) of lenvatinib-treated patients versus 18.3% (3.1% were Grade ≥ 3) of placebo-treated patients. Reactions that occurred at an incidence of ≥ 0.75% above placebo were: epistaxis (11.9%), haematuria (6.5%), contusion (4.6%), gingival bleeding (2.3%), haematochezia (2.3%), rectal haemorrhage (1.5%), haematoma (1.1%), haemorrhoidal haemorrhage (1.1%), laryngeal haemorrhage (1.1%), petechiae (1.1%), and intracranial tumour haemorrhage (0.8%). In this trial, there was 1 case of fatal intracranial haemorrhage among 16 patients who received lenvatinib and had CNS metastases at baseline.

The median time to first onset in lenvatinib-treated patients was 10.1 weeks. No differences between lenvatinib- and placebo-treated patients were observed in the incidences of serious reactions (3.4% vs. 3.8%), reactions leading to premature discontinuation (1.1% vs. 1.5%), or reactions leading to dose interruption (3.4% vs. 3.8%) or reduction (0.4% vs. 0).

HCC

In the Phase 3 REFLECT trial (see section 5.1), haemorrhage was reported in 24.6% of patients and 5.0% were Grade ≥ 3. Grade 3 reactions occurred in 3.4%, Grade 4 reactions in 0.2% and 7 patients (1.5%) had a grade 5 reaction including cerebral haemorrhage, upper gastrointestinal haemorrhage, intestinal haemorrhage and tumour haemorrhage. The median time to first

onset was 11.9 weeks. A haemorrhage event led to dose interruption or reduction in 3.2% and 0.8% patients respectively and to treatment discontinuation in 1.7% of patients.

Across clinical trials in which 1,327 patients received lenvatinib monotherapy in indications other than HCC, Grade ≥ 3 or greater haemorrhage was reported in 2% of patients, 3 patients (0.2%) had a Grade 4 haemorrhage and 8 patients (0.6%) had a Grade 5 reaction including arterial haemorrhage, haemorrhagic stroke, intracranial haemorrhage, intracranial tumour haemorrhage, haematemesis, melaena, haemoptysis and tumour haemorrhage.

EC

In the Phase 3 Study 309 (see section 5.1), haemorrhage was reported in 24.4% of lenvatinib plus pembrolizumab-treated patients and Grade ≥3 reactions occurred in 3.0% of patients. The median time to onset was 65.0 days. Dose interruption, reduction and discontinuation of lenvatinib occurred in 1.7%, 1.2% and 1.7% of patients, respectively.

Hypocalcaemia (see section 4.4)

DTC

In the pivotal Phase 3 SELECT trial (see section 5.1), hypocalcaemia was reported in 12.6% of lenvatinib-treated patients vs. no cases in the placebo arm. The median time to first onset in lenvatinib-treated patients was 11.1 weeks. Reactions of Grade 3 or 4 severity occurred in 5.0% of lenvatinib-treated vs 0 placebo-treated patients. Most reactions resolved following supportive treatment, without dose interruption or reduction, which occurred in 1.5% and 1.1% of patients, respectively; 1 patient with Grade 4 hypocalcaemia discontinued treatment permanently.

HCC

In the Phase 3 REFLECT trial (see section 5.1), hypocalcaemia was reported in 1.1% of patients, with grade 3 reactions occurring in 0.4%. Lenvatinib dose interruption due to hypocalcaemia occurred in one subject (0.2%) and there were no dose reductions or discontinuations.

EC

In the Phase 3 Study 309 (see section 5.1), hypocalcaemia was reported in 3.9% of lenvatinib plus pembrolizumab-treated patients and Grade ≥3 reactions occurred in 1.0% of patients. The median time to onset was 148.0 days. No lenvatinib dose modifications were reported.

Gastrointestinal perforation and fistula formation (see section4.4)

DTC

In the pivotal Phase 3 SELECT trial (see section 5.1), events of gastrointestinal perforation or fistula were reported in 1.9% of lenvatinib-treated patients and 0.8% of patients in the placebo group.

HCC

In the Phase 3 REFLECT trial (see section 5.1), events of gastrointestinal perforation or fistula were reported in 1.9% of lenvatinib-treated patients.

EC

In the Phase 3 Study 309 (see section 5.1), events of fistula formation were reported in 2.5% of lenvatinib plus pembrolizumab-treated patients and Grade ≥3 reactions occurred in 2.5% of patients. The median time to onset was 117.0 days. Discontinuation of lenvatinib occurred in 1.0% of patients. Events of gastrointestinal perforation were reported in 3.9% of lenvatinib plus pembrolizumab-treated patients and Grade ≥3 reactions occurred in 3.0% of patients. The median time to onset was 42 days. Dose interruption and discontinuation of lenvatinib occurred in 0.5% and 3.0% of patients, respectively.

Non-gastrointestinal fistulae (see section 4.4)

Lenvatinib use has been associated with cases of fistulae including reactions resulting in death. Reports of fistulae that involve areas of the body other than stomach or intestines were observed across various indications. Reactions were reported at various time points during treatment ranging from two weeks to greater than 1 year from initiation of lenvatinib, with a median latency of about 3 months.

QT interval prolongation (see section 4.4)

DTC

In the pivotal Phase 3 SELECT trial (see section 5.1), QT/QTc interval prolongation was reported in 8.8% of lenvatinib-treated patients and 1.5% of patients in the placebo group. The incidence of QT interval prolongation of greater than 500 ms was 2% in the lenvatinib-treated patients compared to no reports in the placebo group.

HCC

In the Phase 3 REFLECT trial (see section 5.1), QT/QTc interval prolongation was reported in 6.9% of lenvatinib-treated patients. The incidence of QTcF interval prolongation of greater than 500ms was 2.4%.

EC

In the Phase 3 Study 309 (see section 5.1), QT interval prolongation was reported in 3.9% of lenvatinib plus pembrolizumab-treated patients and Grade ≥3 reactions occurred in 0.5% of patients. The median time to onset was 115.5 days. Dose interruption and reduction of lenvatinib occurred in 0.2% and 0.5% of patients, respectively.

Increased blood thyroid stimulating hormone (see section 4.4)

DTC

In the pivotal Phase 3 SELECT trial (see section 5.1), 88% of all patients had a baseline TSH level less than or equal to 0.5 mU/L. In those patients with a normal TSH at baseline, elevation of TSH level above 0.5 mU/L was observed post baseline in 57% of lenvatinib-treated patients as compared with 14% of placebo-treated patients.

HCC

In the Phase 3 REFLECT trial (see section 5.1), 89.6% of patients had a baseline TSH level of less than the upper limit of normal. Elevation of TSH above the upper limit of normal was observed post baseline in 69.6% of lenvatinib-treated patients.

EC

In the Phase 3 Study 309 (see section 5.1), hypothyroidism was reported in 68.2% of lenvatinib plus pembrolizumab-treated patients and Grade ≥3 reactions occurred in 1.2% of patients. The median time to onset was 62.0 days. Dose interruption and reduction of lenvatinib occurred in 2.2% and 0.7% of patients, respectively.

Blood TSH increased was reported in 12.8% of lenvatinib plus pembrolizumab-treated patients with no patients reporting Grade ≥3 reactions. Dose interruption occurred in 0.2% of patients.

Diarrhoea (see section 4.4)

DTC

In the pivotal Phase 3 SELECT trial (see section 5.1), diarrhoea was reported in 67.4% of patients in the lenvatinib-treated group (9.2% were Grade ≥ 3) and in 16.8% of patients in the placebo group (none were Grade ≥ 3).

HCC

In the Phase 3 REFLECT trial (see section 5.1), diarrhoea was reported in 38.7% of patients treated with lenvatinib (4.2% were Grade ≥ 3).

EC

In the Phase 3 Study 309 (see section 5.1), diarrhoea was reported in 54.2% of lenvatinib plus pembrolizumab-treated patients (7.6% were Grade ≥ 3). Dose interruption, reduction and discontinuation of lenvatinib occurred in 10.6%, 11.1% and 1.2% of patients, respectively.

Paediatric population

In the paediatric Studies 207, 216, 230, and 231 (see section 5.1), the overall safety profile of lenvatinib as a single agent or in combination with either ifosfamide and etoposide or everolimus was consistent with that observed in adults treated with lenvatinib.

In patients with relapsed/refractory osteosarcoma, pneumothorax was reported at a frequency higher than that observed in adults with DTC, HCC, RCC and EC. In Study 207, pneumothorax occurred in 6 patients (10.9%) treated with single-agent lenvatinib and 7 patients (16.7%) treated with lenvatinib in combination with ifosfamide and etoposide. Overall, 2 patients discontinued study treatment due to pneumothorax. In Study 230, pneumothorax was reported in a total of 14 patients (11 patients [28.2%] treated with lenvatinib plus ifosfamide and etoposide, and 3 patients [7.7%] treated with ifosfamide and etoposide). In Study 216, pneumothorax was reported in 3 patients (4.7%) with Ewing sarcoma, rhabdomyosarcoma (RMS) and Wilms tumour; all 3 patients had lung metastases at baseline. In Study 231, pneumothorax was reported in 7 patients (5.5%) with spindle cell sarcoma, undifferentiated sarcoma, RMS, malignant peripheral nerve sheath tumour, synovial sarcoma, spindle cell carcinoma, and malignant fibromyxoid ossifying tumour; all 7 patients had lung metastases or primary disease in the chest wall or pleural cavity at baseline. For Studies 216, 230, and 231, no patient discontinued study treatment due to pneumothorax. Pneumothorax occurrence appeared to be mainly associated with pulmonary metastases and underlying disease.

In the single-agent dose-finding cohort of Study 207, the most frequently (≥40%) reported adverse drug reactions were decreased appetite, diarrhoea, hypothyroidism, vomiting, abdominal pain, pyrexia, hypertension, and weight decreased; and in the single-agent expansion cohort of patients with relapsed or refractory osteosarcoma, the most frequently (≥40%) reported adverse drug reactions were decreased appetite, headache, vomiting, hypothyroidism, and proteinuria.

In the combination dose-finding cohort of Study 207, the most frequently (≥50%) reported adverse drug reactions were vomiting, anaemia, nausea, diarrhoea, hypothyroidism, abdominal pain, arthralgia, epistaxis, neutropenia, constipation, headache, and pain in extremity; and in the combination expansion cohort, the most frequently (≥50%) reported adverse drug reactions were anaemia, nausea, white blood cell count decreased, diarrhoea, vomiting, and platelet count decreased.

In Phase 1 (combination dose-finding cohort) of Study 216, the most frequently (≥40%) reported adverse drug reactions were hypertension, hypothyroidism, hypertriglyceridemia, abdominal pain, and diarrhoea; and in Phase 2 (combination expansion cohort), the most frequently reported (≥35%) adverse drug reactions were hypertriglyceridemia, proteinuria, diarrhoea, lymphocyte count decreased, white blood cell count decreased, blood cholesterol increased, fatigue, and platelet count decreased.

In the OLIE study (Study 230), the most frequently (≥35%) reported adverse drug reactions were hypothyroidism, anaemia, nausea, platelet count decreased, proteinuria, vomiting, back pain, febrile neutropenia, hypertension, constipation, diarrhoea, neutrophil count decreased, and pyrexia.

In Study 231, the most frequently reported (≥15%) adverse drug reactions were hypothyroidism, hypertension, proteinuria, decreased appetite, diarrhoea, and platelet count decreased.

Other special populations

Elderly

DTC

Patients of age ≥75 years were more likely to experience Grade 3 or 4 hypertension, proteinuria, decreased appetite, and dehydration.

HCC

Patients of age ≥75 years were more likely to experience hypertension, proteinuria, decreased appetite, asthenia, dehydration, dizziness, malaise, peripheral oedema, pruritus and hepatic encephalopathy. Hepatic encephalopathy occurred at more than twice the incidence in patients aged ≥75 years (17.2%) than in those <75 years (7.1%). Hepatic encephalopathy tended to be

associated with adverse disease characteristics at baseline or with the use of concomitant medicinal products. Arterial thromboembolic events also occurred at an increased incidence in this age group.

EC

Patients of age ≥75 years were more likely to experience urinary tract infections and Grade ≥3 hypertension (≥ 10% increase compared to patients of age <65 years).

Gender

DTC

Females had a higher incidence of hypertension (including Grade 3 or 4 hypertension), proteinuria, and PPE, while males had a higher incidence of decreased ejection fraction and gastrointestinal perforation and fistula formation.

HCC

Females had a higher incidence of hypertension, fatigue, ECG QT prolongation and alopecia. Men had a higher incidence (26.5%) of dysphonia than women (12.3%), decreased weight and decreased platelet count. Hepatic failure events were observed in male patients only.

Ethnic origin

DTC

Asian patients had a higher (≥ 10% difference) incidence than Caucasian patients of peripheral oedema, hypertension, fatigue, PPE, proteinuria, stomatitis, thrombocytopenia, and myalgia; while Caucasian patients had a higher incidence of diarrhoea, weight decreased, nausea, vomiting, constipation, asthenia, abdominal pain, pain in extremity, and dry mouth. A larger proportion of Asian patients had a lenvatinib dose reduction compared to Caucasian patients. the median time to first dose reduction and the average daily dose taken were lower in Asian than in Caucasian patients.

HCC

Asian patients had a higher incidence than Caucasian patients of proteinuria, decreased neutrophil count, decreased platelet count, decreased white blood count and PPE, while Caucasian patients had a higher incidence of fatigue, hepatic encephalopathy, acute kidney injury, anxiety, asthenia, nausea, thrombocytopenia and vomiting.

EC

Asian patients had a higher (≥10% difference) incidence than Caucasian patients of anaemia, malaise, neutrophil count decrease, stomatitis, platelet count decreased, proteinuria and PPE while Caucasian patients had a higher incidence of mucosal inflammation, abdominal pain, diarrhoea, urinary tract infection, weight decreased, hypomagnesaemia, dizziness, asthenia and fatigue.

Baseline hypertension

DTC

Patients with baseline hypertension had a higher incidence of Grade 3 or 4 hypertension, proteinuria, diarrhoea, and dehydration, and experienced more serious cases of dehydration, hypotension, pulmonary embolism, malignant pleural effusion, atrial fibrillation, and GI symptoms (abdominal pain, diarrhoea, vomiting).

Hepatic impairment

DTC

Patients with baseline hepatic impairment had a higher incidence of hypertension and PPE, and a higher incidence of Grade 3 or 4 hypertension, asthenia, fatigue, and hypocalcaemia compared with patients with normal hepatic function.

HCC

Patients with a baseline Child-Pugh (CP) score of 6 (about 20% patients in the REFLECT study) had a higher incidence of decreased appetite, fatigue, proteinuria, hepatic encephalopathy and hepatic failure compared to patients with a baseline CP score of 5. Hepatotoxicity events and haemorrhage events also occurred at a higher incidence in CP score 6 patients compared to CP score 5 patients.

Renal impairment

DTC

Patients with baseline renal impairment had a higher incidence of Grade 3 or 4 hypertension, proteinuria, fatigue, stomatitis, oedema peripheral, thrombocytopenia, dehydration, prolonged QT, hypothyroidism, hyponatraemia, increased blood thyroid stimulating hormone, pneumonia compared with subjects with normal renal function. These patients also had a higher incidence of renal reactions and a trend towards a higher incidence of liver reactions.

HCC

Patients with baseline renal impairment had a higher incidence of fatigue, hypothyroidism, dehydration, diarrhoea, decreased appetite, proteinuria and hepatic encephalopathy. These patients also had a higher incidence of renal reactions and arterial thromboembolic events.

Patients with bodyweight <60 kg

DTC

Patients with low body weight (<60 kg) had a higher incidence of PPE, proteinuria, of Grade 3 or 4 hypocalcaemia and hyponatraemia, and a trend towards a higher incidence of Grade 3 or 4 decreased appetite.

Reporting of suspected adverse reactions
Reporting suspected adverse reactions after authorisation of the medicinal product is important. It allows continued monitoring of the benefit/risk balance of the medicinal product. Healthcare professionals are asked to report any suspected adverse reactions via HPRA Pharmacovigilance, Website: www.hpra.ie.

4.9 Overdose

The highest doses of lenvatinib studied clinically were 32 mg and 40 mg per day. Accidental medication errors resulting in single doses of 40 to 48 mg have occurred in clinical trials. The most frequently observed adverse drug reactions at these doses were hypertension, nausea, diarrhoea, fatigue, stomatitis, proteinuria, headache, and aggravation of PPE. There have also been reports of overdose with lenvatinib involving single administrations of 6 to 10 times the recommended daily dose. These cases were associated with adverse reactions consistent with the known safety profile of lenvatinib (i.e., renal and cardiac failure), or were without adverse reactions.

Symptoms and Management

There is no specific antidote for overdose with lenvatinib. In case of suspected overdose, lenvatinib should be withheld and appropriate supportive care given as required.

5 PHARMACOLOGICAL PROPERTIES

5.1 Pharmacodynamic properties

Pharmacotherapeutic group: antineoplastic agents, protein kinase inhibitors, ATC code: L01EX08

Lenvatinib is a multikinase inhibitor which has shown mainly antiangiogenic properties in vitro and in vivo, and direct inhibition of tumour growth was also observed in in vitro models.

Mechanism of action

Lenvatinib is a receptor tyrosine kinase (RTK) inhibitor that selectively inhibits the kinase activities of vascular endothelial growth factor (VEGF) receptors VEGFR1 (FLT1), VEGFR2 (KDR), and VEGFR3 (FLT4), in addition to other proangiogenic and oncogenic pathway-related RTKs including fibroblast growth factor (FGF) receptors FGFR1, 2, 3, and 4, the platelet derived growth factor (PDGF) receptor PDGFRα, KIT, and RET.

In addition, lenvatinib had selective, direct antiproliferative activity in hepatocellular cell lines dependent on activated FGFR signalling, which is attributed to the inhibition of FGFR signalling by lenvatinib.

In syngeneic mouse tumour models, lenvatinib decreased tumour-associated macrophages, increased activated cytotoxic T cells, and demonstrated greater antitumour activity in combination with an anti- PD-1 monoclonal antibody compared to either treatment alone.

Although not studied directly with lenvatinib, the mechanism of action (MOA) for hypertension is postulated to be mediated by the inhibition of VEGFR2 in vascular endothelial cells. Similarly, although not studied directly, the MOA for proteinuria is postulated to be mediated by downregulation of VEGFR1 and VEGFR2 in the podocytes of the glomerulus.

The mechanism of action for hypothyroidism is not fully elucidated.

Clinical efficacy

Radioiodine-refractory differentiated thyroid cancer

The SELECT study was a multicentre, randomised, double-blind, placebo-controlled trial that was conducted in 392 patients with radioiodine-refractory differentiated thyroid cancer with independent, centrally reviewed, radiographic evidence of disease progression within 12 months (+1 month window) prior to enrolment. Radioiodine-refractory was defined as one or more measurable lesions either with a lack of iodine uptake or with progression in spite of radioactive-iodine (RAI) therapy, or having a cumulative activity of RAI of >600 mCi or 22 GBq with the last dose at least 6 months prior to study entry. Randomisation was stratified by geographic region (Europe, North America, and Other), prior VEGF/VEGFR-targeted therapy (patients may have received 0 or 1 prior VEGF/VEGFR-targeted therapy), and age (≤65 years or >65 years). The main efficacy outcome measure was progression-free survival (PFS) as determined by blinded independent radiologic review using Response Evaluation Criteria in Solid Tumours (RECIST) 1.1. Secondary efficacy outcome measures included overall response rate and overall survival. Patients in the placebo arm could opt to receive lenvatinib treatment at the time of confirmed disease progression.

Eligible patients with measurable disease according to RECIST 1.1 were randomised 2:1 to receive lenvatinib 24 mg once daily (n=261) or placebo (n=131). Baseline demographics and disease characteristics were well balanced for both treatment groups. Of the 392 patients randomised, 76.3% were naïve to prior VEGF/VEGFR-targeted therapies, 49.0% were female, 49.7% were European, and the median age was 63 years. Histologically, 66.1% had a confirmed diagnosis of papillary thyroid cancer and 33.9% had follicular thyroid cancer which included Hürthle cell 14.8% and clear cell 3.8%. Metastases were present in 99% of the patients: lungs in 89.3%, lymph nodes in 51.5%, bone in 38.8%, liver in 18.1%, pleura in 16.3%, and brain in 4.1%. The majority of patients had an ECOG performance status of 0; 42.1% had a status of 1; 3.9% had a status above 1. The median cumulative RAI activity administered prior to study entry was 350 mCi (12.95 GBq).

A statistically significant prolongation in PFS was demonstrated in lenvatinib-treated patients compared with those receiving placebo ($p<0.0001$) (see figure 1). The positive effect on PFS was seen across the subgroups of age (above or below 65 years), sex, race, histological subtype, geographic region, and those who received 0 or 1 prior VEGF/VEGFR-targeted therapies. Following independent review confirmation of disease progression, 109 (83.2%) patients randomised to placebo had crossed over to open-label lenvatinib at the time of the primary efficacy analysis.

The objective response rate (complete response [CR] plus partial response [PR]) per independent radiological review was significantly ($p<0.0001$) higher in the lenvatinib-treated group (64.8%) than in the placebo-treated group (1.5%). Four (1.5%) subjects treated with lenvatinib attained a CR and 165 subjects (63.2%) had a PR, while no subjects treated with placebo had a CR and 2 (1.5%) subjects had a PR.

The median time to first dose reduction was 2.8 months. The median time to objective responsive was 2.0 (95% CI: 1.9, 3.5) months; however, of the patients who experienced a complete or partial response to lenvatinib, 70.4% were observed to develop the response on or within 30 days of being on the 24-mg dose.

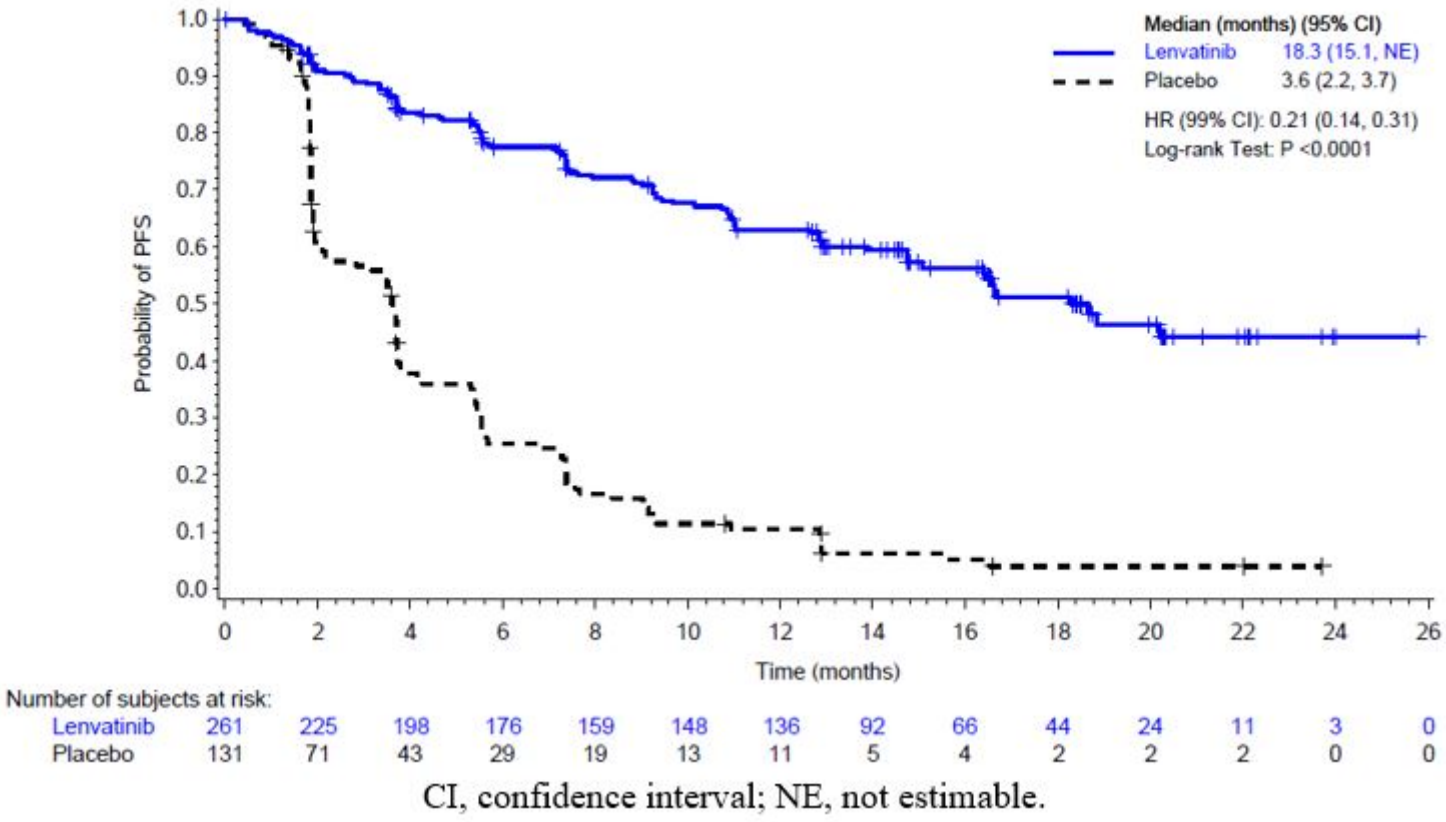
The overall survival analysis was confounded by the fact that placebo-treated subjects with confirmed disease progression had the option to cross over to open-label lenvatinib. There was no statistically significant difference in overall survival between the

treatment groups at the time of the primary efficacy analysis (HR=0.73; 95% CI: 0.50, 1.07, p=0.1032). The median Overall Survival (OS) had not been reached for either the lenvatinib group or the placebo crossover group.

Table 7 Efficacy results in DTC patients	**Lenvatinib N=261**	**Placebo N=131**
Progression-Free Survival (PFS)[a]		
Number of progressions or deaths (%)	107 (41.0)	113 (86.3)
Median PFS in months (95% CI)	18.3 (15.1, NE)	3.6 (2.2, 3.7)
Hazard ratio (99% CI)[b,c]	0.21 (0.14, 0.31)	
P value[b]	<0.0001	
Patients who had received 0 prior VEGF/VEGFR-targeted therapy (%)	195 (74.7)	104 (79.4)
Number of progressions or deaths	76	88
Median PFS in months (95% CI)	18.7 (16.4, NE)	3.6 (2.1, 5.3)
Hazard ratio (95% CI)[b,c]	0.20 (0.14, 0.27)	
Patients who had received 1 prior VEGF/VEGFR-targeted therapy (%)	66 (25.3)	27 (20.6)
Number of progressions or deaths	31	25
Median PFS in months (95% CI)	15.1 (8.8, NE)	3.6 (1.9, 3.7)
Hazard ratio (95% CI)[b,c]	0.22 (0.12, 0.41)	
Objective Response Rate[a]		
Number of objective responders (%)	169 (64.8)	2 (1.5)
(95% CI)	(59.0, 70.5)	(0.0, 3.6)
P value[b]	<0.0001	
Number of complete responses	4	0
Number of partial responses	165	2
Median time to objective response,[d] months (95% CI)	2.0 (1.9, 3.5)	5.6 (1.8, 9.4)
Duration of response,[d] months, median (95% CI)	NE (16.8, NE)	NE (NE, NE)
Overall Survival		
Number of deaths (%)	71 (27.2)	47 (35.9)
Median OS in months (95% CI)	NE (22.0, NE)	NE (20.3, NE)
Hazard ratio (95% CI)[b, e]	0.73 (0.50, 1.07)	
P value [b, e]	0.1032	

CI, confidence interval; NE, not estimable; OS, overall survival; PFS, progression-free survival; RPSFT, rank preserving structural failure time model; VEGF/VEGFR, vascular endothelial growth factor / vascular endothelial growth factor receptor.
a: Independent radiologic review.
b: Stratified by region (Europe vs. North America vs. Other), age group (≤65 years vs >65 years), and previous VEGF/VEGFR-targeted therapy (0 vs. 1).
c: Estimated with Cox proportional hazard model.
d: Estimated using the Kaplan-Meier method; the 95% CI was constructed with a generalised Brookmeyer and Crowley method in patients with a best overall response of complete response or partial response.
e: Not adjusted for crossover effect.

Figure 1 Kaplan-Meier Curve of Progression-Free Survival - DTC



CI, confidence interval; NE, not estimable.

Hepato cellular carcinoma

The clinical efficacy and safety of lenvatinib have been evaluated in an international, multicenter, open-label, randomised phase 3 study (REFLECT) in patients with unresectable hepatocellular carcinoma (HCC).

In total, 954 patients were randomised 1:1 to receive either lenvatinib (12 mg [baseline body weight ≥60 kg] or 8 mg [baseline body weight <60 kg]) given orally once daily or sorafenib 400 mg given orally twice daily.

Patients were eligible to participate if they had a liver function status of Child-Pugh class A and Eastern Cooperative Oncology Group Performance Status (ECOG PS) 0 or 1. Patients were excluded who had prior systemic anticancer therapy for advanced/unresectable HCC or any prior anti-VEGF therapy. Target lesions previously treated with radiotherapy or locoregional therapy had to show radiographic evidence of disease progression. Patients with ≥ 50% liver occupation, clear invasion into the bile duct or a main branch of the portal vein (Vp4) on imaging were also excluded.

- Demographic and baseline disease characteristics were similar between the lenvatinib and the sorafenib groups and are shown below for all 954 randomised patients:
- Median age: 62 years
- Male: 84%
- White: 29%, Asian: 69%, Black or African American: 1.4%
- Body weight: <60 kg -31%, 60-80 kg – 50%, >80 kg - 19%
- Eastern Cooperative Oncology Group Performance Status (ECOG PS) of 0: 63%, ECOG PS of 1: 37%
- Child-Pugh A: 99%, Child-Pugh B: 1%
- Aetiology: Hepatitis B (50%), Hepatitis C (23%), alcohol (6%)
- Absence of macroscopic portal vein invasion (MPVI): 79%
- Absence of MPVI, extra-hepatic tumour spread (EHS) or both: 30%
- Underlying cirrhosis (by independent imaging review): 75%
- Barcelona Clinic Liver Cancer (BCLC) stage B: 20%; BCLC stage C: 80%
- Prior treatments: hepatectomy (28%), radiotherapy (11%), loco-regional therapies including transarterial (chemo)embolisation (52%), radiofrequency ablation (21%) and percutaneous ethanol injection (4%)

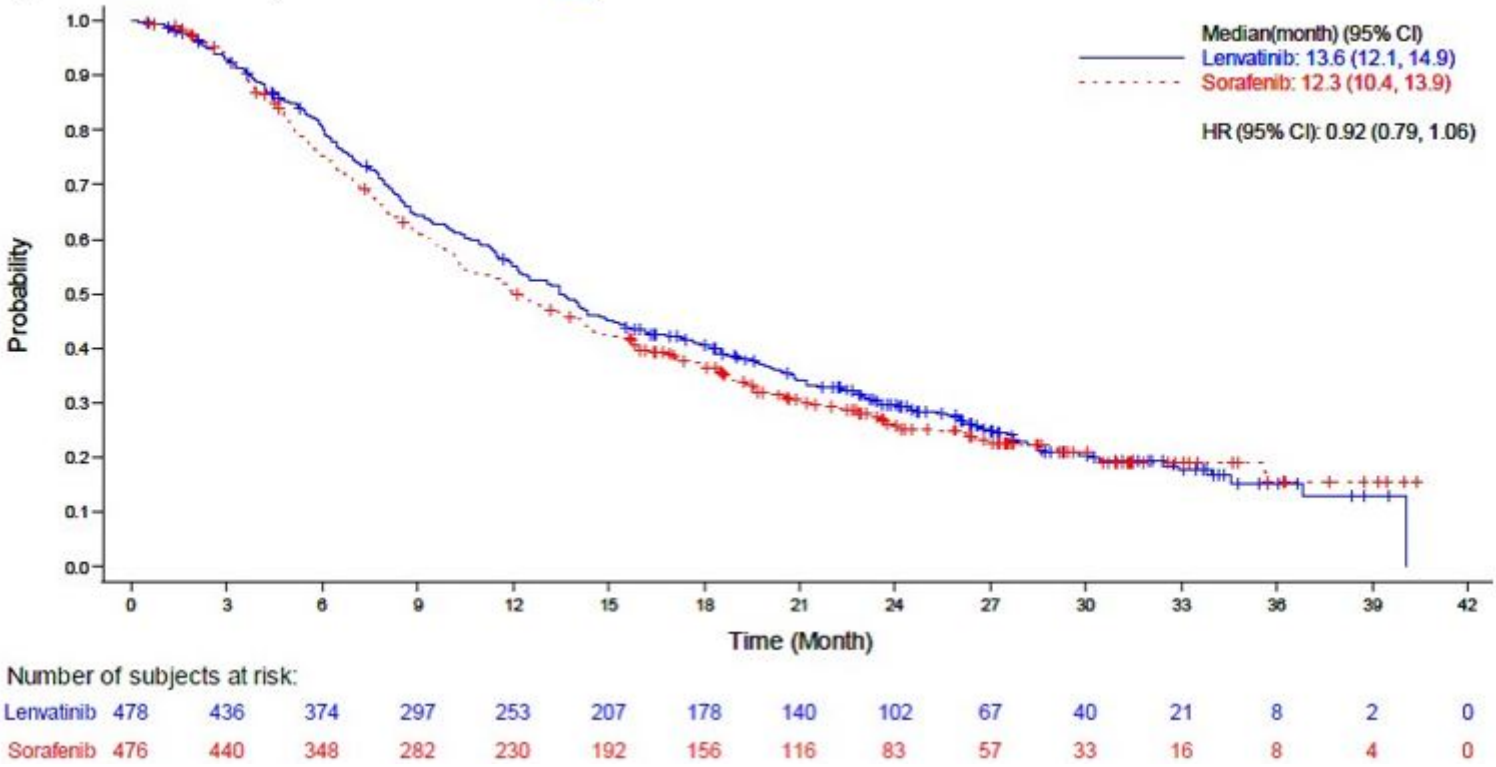
The primary efficacy endpoint was Overall Survival (OS). Lenvatinib was non-inferior for OS to sorafenib with HR = 0.92 [95% CI of (0.79, 1.06)] and a median OS of 13.6 months vs 12.3 months (see Table 8 and Figure 2). The results for surrogate endpoints (PFS and ORR) are presented in Table 8 below.

Table 8 Efficacy Results from the REFLECT study in HCC

	Hazard ratio[a, b]		**Median (95% CI)[e]**	
Efficacy parameter	**(95% CI)**	**P valued**	**Lenvatinib (N=478)**	**Sorafenib (N=476)**
OS	0.92 (0.79,1.06)	NA	13.6 (12.1, 14.9)	12.3 (10.4, 13.9)
PFS[g] (mRECIST)	0.64 (0.55, 0.75)	<0.00001	7.3 (5.6, 7.5)	3.6 (3.6, 3.7)
			Percentages (95% CI)	
ORR[c, f, g] (mRECIST)	NA	<0.00001	41% (36%, 45%)	12% (9%, 15%)

Data cut-off date: 13 Nov 2016.
a. Hazard ratio (HR) is for lenvatinib vs. sorafenib, based on a Cox model including treatment group as a factor.
b. Stratified by region (Region 1: Asia-Pacific; Region 2: Western), macroscopic portal vein invasion or extrahepatic spread or both (yes, no), ECOG PS (0, 1) and body weight (<60 kg, ≥60 kg).
c. Results are based on confirmed and unconfirmed responses.
d. P- value is for the superiority test of lenvatinib versus sorafenib.
e. Quartiles are estimated by the Kaplan-Meier method, and the 95% CIs are estimated with a generalised Brookmeyer and Crowley method
f. Response rate (complete or partial response)
g..Per independent radiology review retrospective analysis. The median duration of objective response was 7.3 (95% CI 5.6, 7.4) months in the lenvatinib arm and 6.2 (95% CI 3.7, 11.2) months in the sorafenib arm.

Figure 2 Kaplan-Meier Curve Of Overall Survival - HCC



1. Data cut-off date = 13 Nov 2016.
2. Noninferiority margin for hazard ratio (HR: lenvatinib vs sorafenib = 1.08).
3. Median was estimated with the Kaplan-Meier method and the 95% confidence interval was constructed with a generalised Brookmeyer and Crowley method.
4. HR was estimated from the Cox proportional hazard model with treatment as independent variable and stratified by IxRS stratification factors. The Efron method was used for ties.

5. + = censored observations.

In subgroup analyses by stratification factors (presence or absence of MPVI or EHS or both, ECOG PS 0 or 1, BW <60 kg or ≥60 kg and region) the HR consistently favoured lenvatinib over sorafenib, with the exception of Western region [HR of 1.08 (95% CI 0.82, 1.42], patients without EHS [HR of 1.01 (95% CI 0.78, 1.30)] and patients without MPVI, EHS or both [HR of 1.05 (0.79, 1.40)]. The results of subgroup analyses should be interpreted with caution.

The median duration of treatment was 5.7 months (Q1: 2.9, Q3: 11.1) in the lenvatinib arm and 3.7 months (Q1: 1.8, Q3: 7.4) in the sorafenib arm.

In both treatment arms in the REFLECT study, median OS was approximately 9 months longer in subjects who received post-treatment anticancer therapy than in those who did not. In the lenvatinib arm, median OS was 19.5 months (95% CI: 15.7, 23.0) for subjects who received post-treatment anticancer therapy (43%) and 10.5 months (95% CI: 8.6, 12.2) for those who did not. In the sorafenib arm, median OS was 17.0 months (95% CI: 14.2, 18.8) for subjects who received posttreatment anticancer therapy (51%) and 7.9 months (95% CI: 6.6, 9.7) for those who did not. Median OS was longer by approximately 2.5 months in the lenvatinib compared with the sorafenib arm in both subsets of subjects (with or without post-treatment anticancer therapy).

Endometrial carcinoma

The efficacy of lenvatinib in combination with pembrolizumab was investigated in Study 309, a randomised, multicentre, open-label, active-controlled study conducted in patients with advanced EC who had been previously treated with at least one prior platinum-based chemotherapy regimen in any setting, including in the neoadjuvant and adjuvant settings. Participants may have received up to 2 platinum-containing therapies in total, as long as one was given in the neoadjuvant or adjuvant treatment setting. The study excluded patients with endometrial sarcoma (including carcinosarcoma), or patients who had active autoimmune disease or a medical condition that required immunosuppression. Randomisation was stratified by mismatch repair (MMR) status (dMMR or pMMR [not dMMR]) using a validated IHC test. The pMMR stratum was further stratified by ECOG performance status, geographic region, and history of pelvic radiation. Patients were randomised (1:1) to one of the following treatment arms:

- lenvatinib 20 mg orally once daily in combination with pembrolizumab 200 mg intravenously every 3 weeks.
- investigator's choice consisting of either doxorubicin 60 mg/m^2 every 3 weeks, or paclitaxel 80 mg/m^2 given weekly, 3 weeks on/1 week off.

Treatment with lenvatinib and pembrolizumab continued until RECIST v1.1-defined progression of disease as verified by Blinded Independent Central Review (BICR), unacceptable toxicity, or for pembrolizumab, a maximum of 24 months. Administration of study treatment was permitted beyond RECIST-defined disease progression if the treating investigator considered the patient to be deriving clinical benefit and the treatment was tolerated. A total of 121/411 (29%) of the lenvatinib and pembrolizumab-treated patients received continued study therapy beyond RECIST-defined disease progression. The median duration of post-progression therapy was 2.8 months. Assessment of tumour status was performed every 8 weeks.

A total of 827 patients were enrolled and randomised to lenvatinib in combination with pembrolizumab (n=411) or investigator's choice of doxorubicin (n=306) or paclitaxel (n=110). The baseline characteristics of these patients were: median age of 65 years (range 30 to 86), 50% age 65 or older; 61% White, 21% Asian, and 4% Black; ECOG PS of 0 (59%) or 1 (41%), and 84% with pMMR tumour status, and 16% with dMMR tumour status. The histologic subtypes were endometrioid carcinoma (60%), serous (26%), clear cell carcinoma (6%), mixed (5%), and other (3%). All 827 of these patients received prior systemic therapy for EC: 69% had one, 28% had two, and 3% had three or more prior systemic therapies. Thirty-seven percent of patients received only prior neoadjuvant or adjuvant therapy. The median duration of study treatment was 7.6 months (range 1 day to 26.8 months). The median duration of exposure to lenvatinib was 6.9 months (range 1 day to 26.8 months).

The primary efficacy outcome measures were OS and PFS (as assessed by BICR using RECIST 1.1). Secondary efficacy outcome measures included ORR, as assessed by BICR using RECIST 1.1. At the pre-specified interim analysis, with a median follow-up time of 11.4 months (range: 0.3 to 26.9 months), the study demonstrated a statistically significant improvement in OS and PFS in the all- comer population.

Efficacy results by MMR subgroups were consistent with overall study results.

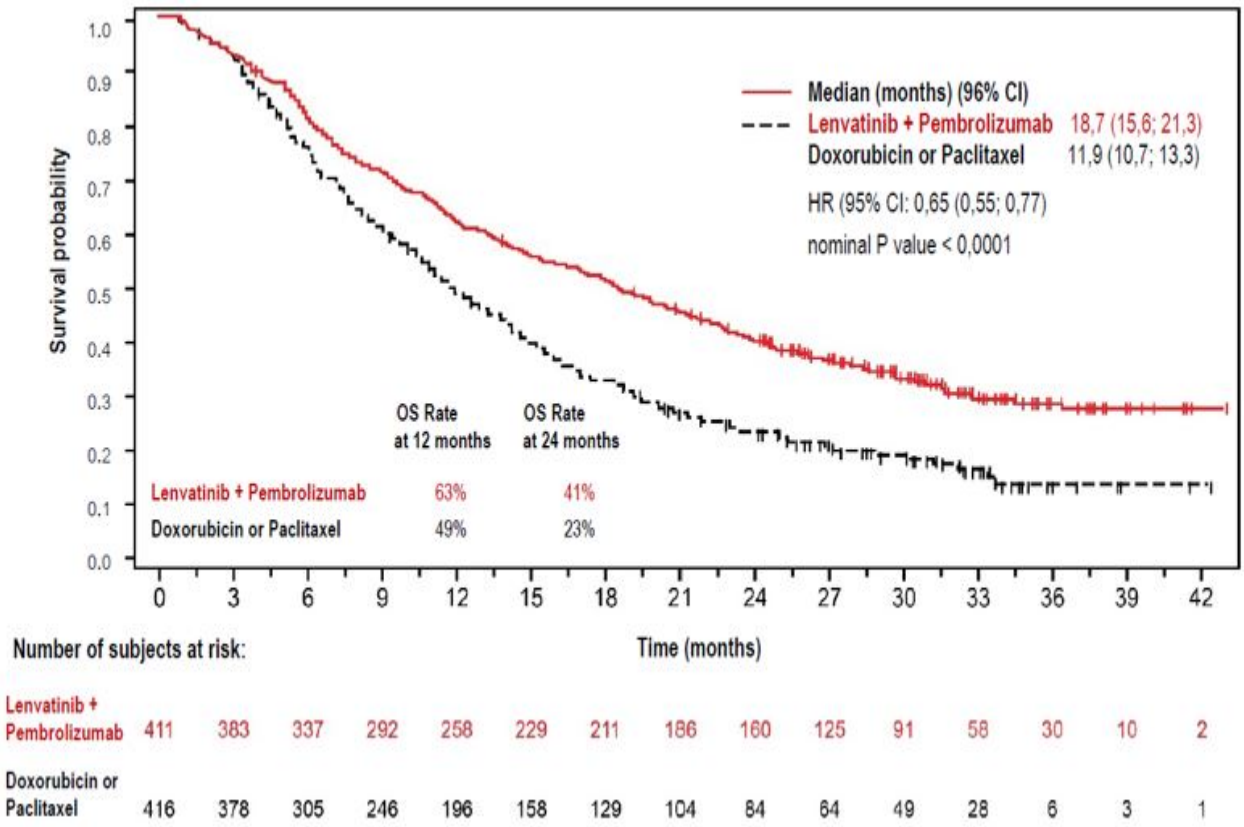
The pre-specified final OS analysis with approximately 16 months of additional follow-up duration from the interim analysis (overall median follow-up time of 14.7 months [range: 0.3 to 43.0 months]) was performed without multiplicity adjustment. The efficacy results in the all-comer population are summarised in Table 9. Kaplan-Meier curves for final OS and interim PFS analyses are shown in Figures 3 and 4, respectively.

Table 9 Efficacy Results in Endometrial Carcinoma in Study 309

Endpoint	**Lenvatinib with pembrolizumab N=411**	**Doxorubicin or Paclitaxel N=416**
OS		
Number (%) of patients with event	276 (67%)	329 (79%)
Median in months (95% CI)	18.7 (15.6, 21.3)	11.9 (10.7, 13.3)
Hazard ratio[a] (95% CI)	0.65 (0.55, 0.77)	
P value[b]	<0.0001	
PFS[d]		
Number (%) of patients with event	281 (68%)	286 (69%)
Median in months (95% CI)	7.2 (5.7, 7.6)	3.8 (3.6, 4.2)
Hazard ratio[a] (95% CI)	0.56 (0.47, 0.66)	
P value[c]	<0.0001	
ORR[d]		
ORR[e] (95% CI)	32% (27, 37)	15% (11,18)
Complete response	7%	3%
Partial response	25%	12%
P value[f]	<0.0001	
Duration of Response[d]		
Median in months[g] (range)	14.4 (1.6+, 23.7+)	5.7 (0.0+, 24.2+)

a Based on the stratified Cox regression model
b One-sided nominal p-Value based on stratified log-rank test (final analysis). At the pre-specified interim analysis of OS with a median follow-up time of 11.4 months (range: 0.3 to 26.9 months), statistically significant superiority was achieved for OS comparing the combination of lenvatinib and pembrolizumab with doxorubicin or paclitaxel (HR: 0.62 [95%CI: 0.51, 0.75] p-Value <0.0001).
c One-sided p-Value based on stratified log-rank test
d At pre-specified interim analysis
e Response: Best objective response as confirmed complete response or partial response
f Based on Miettinen and Nurminen method stratified by ECOG performance status, geographic region, and history of pelvic radiation.
g Based on Kaplan-Meier estimation

Figure 3 Kaplan-Meier Curves for Overall Survival in Study 309*

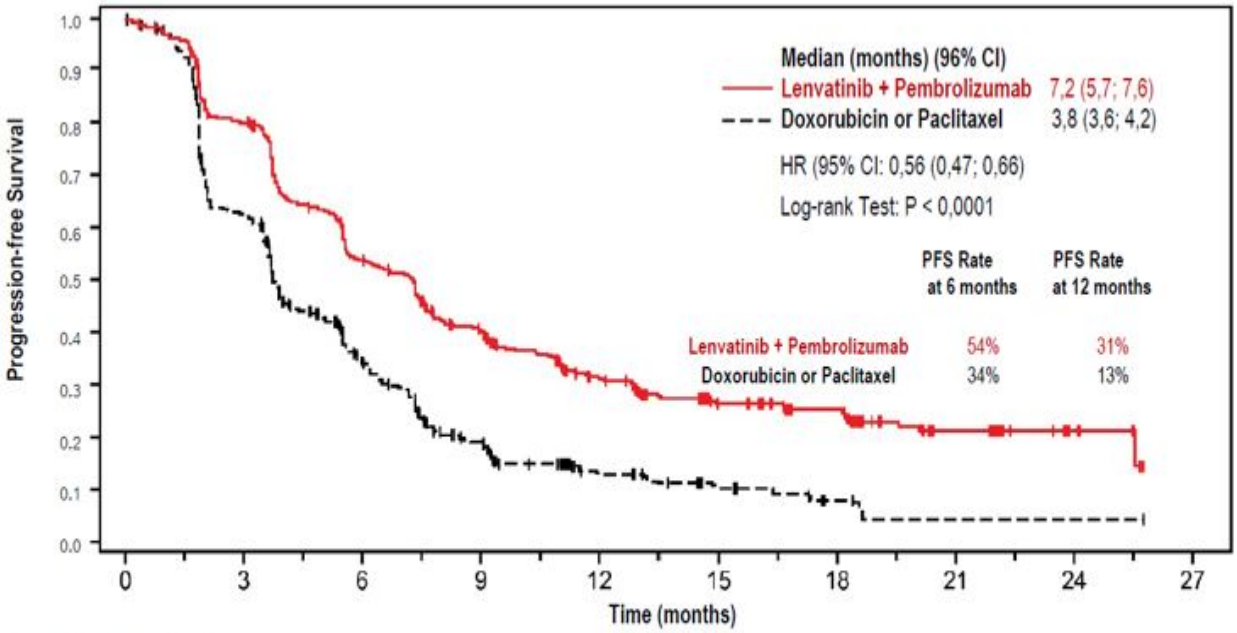


Number of subjects at risk:

Lenvatinib + Pembrolizumab	411	383	337	292	258	229	211	186	160	125	91	58	30	10	2
Doxorubicin or Paclitaxel	416	378	305	246	196	158	129	104	84	64	49	28	6	3	1

*Based on the protocol-specified final analysis

Figure 4 Kaplan-Meier Curves for Progression-Free Survival in Study 309



Number of subjects at risk:

Lenvatinib + Pembrolizumab	411	316	202	144	86	56	43	17	6	0
Doxorubicin or Paclitaxel	416	214	95	42	18	10	4	1	1	0

<u>QT interval prolongation</u>

A single 32- mg dose of lenvatinib did not prolong the QT/QTc interval based on results from a thorough QT study in healthy volunteers; however, QT/QTc interval prolongation has been reported at a higher incidence in patients treated with lenvatinib than in patients treated with placebo (see sections 4.4 and 4.8).

Paediatric population

The European Medicines Agency has deferred the obligation to submit the results of studies with the reference medicinal product containing lenvatinib in one or more subsets of the paediatric population in the treatment of hepatocellular carcinoma (HCC) and endometrial carcinoma (EC) (see section 4.2 for information on paediatric use).

Paediatric studies

The efficacy of lenvatinib was assessed but not established in four open-label studies:

Study 207 was a Phase 1/2, open-label, multi-centre, dose-finding and activity-estimating study of lenvatinib as a single agent and in combination with ifosfamide and etoposide in paediatric patients (aged 2 to <18 years; 2 to ≤25 years for osteosarcoma), with relapsed or refractory solid tumours. A total of 97 patients were enrolled. In the lenvatinib single agent dose-finding cohort, 23 patients were enrolled and received lenvatinib orally, once daily, across 3 dose levels (11, 14, or 17 mg/m^2). In the lenvatinib in combination with ifosfamide and etoposide dose-finding cohort, a total of 22 patients were enrolled and received lenvatinib across 2 dose levels (11 or 14 mg/m^2). The recommended dose (RD) of lenvatinib as a single agent, and in combination with ifosfamide and etoposide was determined as 14 mg/m^2 orally, once daily.

In the lenvatinib single agent expansion cohort of relapsed or refractory DTC, the primary efficacy outcome measure was objective response rate (ORR; complete response [CR] + partial response [PR]). One patient was enrolled, and this patient achieved a PR. In both the lenvatinib single agent, and combination with ifosfamide and etoposide expansion cohorts of relapsed or refractory osteosarcoma, the primary efficacy outcome measure was progression-free survival rate at 4 months (PFS-4); the PFS-4 by binomial estimate including all 31 patients treated with lenvatinib as a single agent was 29% (95%CI: 14.2, 48.0); the PFS-4 by binomial estimate in all 20 patients treated in the lenvatinib in combination with ifosfamide and etoposide expansion cohort was 50% (95%CI: 27.2, 72.8).

Study 216 was a multicentre, open-label, single-arm, Phase 1/2 study to determine the safety, tolerability, and antitumour activity of lenvatinib administered in combination with everolimus in paediatric patients (and young adults aged ≤21 years) with relapsed or refractory solid malignancies, including CNS tumours. A total of 64 patients were enrolled and treated. In Phase 1 (combination dose-finding), 23 patients were enrolled and treated: 5 at Dose Level –1 (lenvatinib 8 mg/m^2 and everolimus 3 mg/m2) and 18 at Dose Level 1 (lenvatinib 11 mg/m^2 and everolimus 3 mg/m2). The recommended dose (RD) of the combination was lenvatinib 11 mg/m^2 and everolimus 3 mg/m^2, taken once daily. In Phase 2 (combination expansion), 41 patients were enrolled and treated at the RD in the following cohorts: Ewing Sarcoma (EWS, n=10), Rhabdomyosarcoma (RMS, n=20), and High-grade glioma (HGG, n=11). The primary efficacy outcome measure was objective response rate (ORR) at Week 16 in evaluable patients based on investigator assessment using RECIST v1.1 or RANO (for patients with HGG). There were no objective responses observed in the EWS and HGG cohorts; 2 partial responses (PRs) were observed in the RMS cohort for an ORR at Week 16 of 10% (95% CI: 1.2, 31.7).

The OLIE study (Study 230) was a Phase 2, open-label, multi-centre, randomized, controlled trial in patients (aged 2 to ≤25 years) with relapsed or refractory osteosarcoma. A total of 81 patients were randomized in a 1:1 ratio (78 treated; 39 in each arm) to lenvatinib 14 mg/m^2 in combination with ifosfamide 3000 mg/m^2 and etoposide 100 mg/m^2 (Arm A) or ifosfamide 3000 mg/m^2 and etoposide 100 mg/m^2 (Arm B). Ifosfamide and etoposide were administered intravenously on Days 1 to 3 of each 21-day cycle for a maximum of 5 cycles. Treatment with lenvatinib was permitted until RECIST v1.1- defined disease progression as verified by Blinded Independent Central Review (BICR) or unacceptable toxicity. The primary efficacy outcome measure was progression-free survival (PFS) per RECIST 1.1 by BICR. The trial did not demonstrate a statistically significant difference in median PFS: 6.5 months (95%CI: 5.7, 8.2) for lenvatinib in combination with ifosfamide and etoposide versus 5.5 months (95%CI: 2.9, 6.5) for ifosfamide and etoposide (HR=0.54 [95%CI: 0.27, 1.08]). Study 230 was not powered to detect a statistically significant difference in OS. At the end of study analysis, the HR was 0.93 (95% CI: 0.53, 1.62) for the comparison of lenvatinib in combination with ifosfamide and etoposide versus ifosfamide and etoposide, with median OS 12.4 months (95% CI 10.4, 19.8) versus 17.2 months (95% CI 11.1, 22.3), respectively, and median follow-up time 24.1 months and 29.5 months, respectively.

Study 231 is a multicentre, open-label, Phase 2 basket study to evaluate the antitumour activity and safety of lenvatinib in children, adolescents, and young adults between 2 to ≤21 years of age with relapsed or refractory solid malignancies, including EWS, RMS, and HGG. A total of 127 patients were enrolled and treated at the lenvatinib RD (14 mg/m^2) in the following cohorts: EWS (n=9), RMS (n=17), HGG (n=8), and other solid tumours (n=9 each for diffuse midline glioma, medulloblastoma, and ependymoma; all other solid tumours n=66). The primary efficacy outcome measure was ORR at Week 16 in evaluable patients based on investigator assessment using RECIST v1.1 or RANO (for patients with HGG). There were no objective responses

observed in patients with HGG, diffuse midline glioma, medulloblastoma, or ependymoma. Two PRs were observed in both the EWS and RMS cohorts for an ORR at Week 16 of 22.2% (95% CI: 2.8, 60.0) and 11.8% (95% CI: 1.5, 36.4), respectively. Five PRs (in patients with synovial sarcoma [n=2], kaposiform hemangioendothelioma [n=1], Wilms tumour nephroblastoma [n=1], and clear cell carcinoma [n=1]) were observed among all other solid tumours for an ORR at Week 16 of 7.7% (95% CI: 2.5, 17.0).

5.2 Pharmacokinetic properties

Pharmacokinetic parameters of lenvatinib have been studied in healthy adult subjects, adult subjects with hepatic impairment, renal impairment, and solid tumours.

Absorption
Lenvatinib is rapidly absorbed after oral administration with t_{max} typically observed from 1 to 4 hours postdose. Food does not affect the extent of absorption, but slows the rate of absorption. When administered with food to healthy subjects, peak plasma concentrations are delayed by 2 hours. Absolute bioavailability has not been determined in humans; however, data from a mass-balance study suggest that it is in the order of 85%. Lenvatinib exhibited good oral bioavailability in dogs (70.4%) and monkeys (78.4%).

Distribution
Invitro binding of lenvatinib to human plasma proteins is high and ranged from 98% to 99% (0.3 - 30 µg/mL, mesilate). This binding was mainly to albumin with minor binding to α1-acid glycoprotein and γ-globulin.
Invitro, the lenvatinib blood-to-plasma concentration ratio ranged from 0.589 to 0.608 (0.1 – 10 µg/mL, mesilate).

Lenvatinib is a substrate for P-gp and BCRP.. Lenvatinib is not a substrate for OAT1, OAT3, OATP1B1, OATP1B3, OCT1, OCT2, MATE1, MATE2-K or the bile salt export pump BSEP.

In patients, the median apparent volume of distribution (Vz/F) of the first dose ranged from 50.5 L to 92 L and was generally consistent across the dose groups from 3.2 mg to 32 mg. The analogous median apparent volume of distribution at steady-state (Vz/Fss) was also generally consistent and ranged from 43.2 L to 121 L.

Biotransformation

In vitro, cytochrome P450 3A4 was demonstrated as the predominant (>80%) isoform involved in the P450-mediated metabolism of lenvatinib. However, *invivo* data indicated that non-P450-mediated pathways contributed to a significant portion of the overall metabolism of lenvatinib. Consequently, *invivo,* inducers and inhibitors of CYP 3A4 had a minimal effect on lenvatinib exposure (see section 4.5).

In human liver microsomes, the demethylated form of lenvatinib (M2) was identified as the main metabolite. M2' and M3', the major metabolites in human faeces, were formed from M2 and lenvatinib, respectively, by aldehyde oxidase.

In plasma samples collected up to 24 hours after administration, lenvatinib constituted 97% of the radioactivity in plasma radiochromatograms while the M2 metabolite accounted for an additional 2.5%. Based on $AUC_{(0-inf)}$, lenvatinib accounted for 60% and 64% of the total radioactivity in plasma and blood, respectively.

Data from a human mass balance/excretion study indicate lenvatinib is extensively metabolised in humans. The main metabolic pathways in humans were identified as oxidation by aldehyde oxidase, demethylation via CYP3A4, glutathione conjugation with elimination of the O-aryl group (chlorophenyl moiety), and combinations of these pathways followed by further biotransformations (e.g., glucuronidation, hydrolysis of the glutathione moiety, degradation of the cysteine moiety, and intramolecular rearrangement of the cysteinylglycine and cysteine conjugates with subsequent dimerisation). These *invivo* metabolic routes align with the data provided in the *in vitro*studies using human biomaterials.

In vitro transporter studies

For the following transporters, OAT1, OAT3, OATP1B1, OCT1, OCT2, and BSEP, clinically relevant inhibition was excluded based on a cutoff of IC50> 50 × C_{max}, unbound.
Lenvatinib showed minimal or no inhibitory activities toward P-gp-mediated and breast cancer resistance protein (BCRP)-mediated transport activities. Similarly, no induction of P-gp mRNA expression was observed .

Lenvatinib showed minimal or no inhibitory effect on OATP1B3 and MATE2-K. Lenvatinib weakly inhibits MATE1. In human liver cytosol, lenvatinib did not inhibit aldehyde oxidase activity.

Elimination

Plasma concentrations decline bi-exponentially following C_{max}. The mean terminal exponential half-life of lenvatinib is approximately 28 hours.

Following administration of radiolabelled lenvatinib to 6 patients with solid tumours, approximately two-thirds and one-quarter of the radiolabel were eliminated in the faeces and urine, respectively. The M3 metabolite was the predominant analyte in excreta (~17% of the dose), followed by M2' (~11% of the dose) and M2 (~4.4 of the dose).

Linearity/non-linearity

Dose proportionality and accumulation

In patients with solid tumours administered single and multiple doses of lenvatinib once daily, exposure to lenvatinib (C_{max} and AUC) increased in direct proportion to the administered dose over the range of 3.2 to 32 mg once-daily.

Lenvatinib displays minimimal accumulation at steady state. Over this range, the median accumulation index (Rac) ranged from 0.96 (20 mg) to 1.54 (6.4 mg). The Rac in HCC subjects with mild and moderate liver impairment was similar to that reported for other solid tumours.

Special populations

Hepatic impairment

The pharmacokinetics of lenvatinib following a single 10-mg dose were evaluated in 6 subjects each with mild and moderate hepatic impairment (Child-Pugh A and Child-Pugh B, respectively). A 5-mg dose was evaluated in 6 subjects with severe hepatic impairment (Child-Pugh C). Eight healthy, demographically matched subjects served as controls and received a 10-mg dose. Lenvatinib exposure, based on dose-adjusted AUC_{0-t} and AUC_{0-inf} data, was 119%, 107%, and 180% of normal for subjects with mild, moderate, and severe hepatic impairment, respectively. It has been determined that plasma protein binding in plasma from hepatically impaired subjects was similar to the respective matched healthy subjects and no concentration dependency was observed. See section 4.2 for dosing recommendation.

There are not sufficient data for HCC patients with Child-Pugh B (moderate hepatic impairment, 3 patients treated with lenvatinib in the pivotal trial) and no data available in Child-Pugh C HCC patients (severe hepatic impairment). Lenvatinib is mainly eliminated via the liver and exposure might be increased in these patient populations.

The median half-life was comparable in subjects with mild, moderate, and severe hepatic impairment as well as those with normal hepatic function and ranged from 26 hours to 31 hours. The percentage of the dose of lenvatinib excreted in urine was low in all cohorts (<2.16% across treatment cohorts).

Renal impairment

The pharmacokinetics of lenvatinib following a single 24-mg dose were evaluated in 6 subjects each with mild, moderate, and severe renal impairment, and compared with 8 healthy, demographically matched subjects. Subjects with end-stage renal disease were not studied.

Lenvatinib exposure, based on AUC_0-inf data, was 101%, 90%, and 122% of normal for subjects with mild, moderate, and severe renal impairment, respectively. It has been determined that plasma protein binding in plasma from renally impaired subjects was similar to the respective matched healthy subjects and no concentration dependency was observed. See section 4.2 for dosing recommendation.

Age, sex, weight, race

Based on a population pharmacokinetic analysis of patients receiving up to 24 mg lenvatinib once daily, age, sex, weight, and race (Japanese vs. other, Caucasian vs. other) had no clinically relevant effects on clearance (see section 4.2).

Paediatric Population

Based on a population pharmacokinetics analysis in paediatric patients of 2 to 12 years old, which included data from 3 paediatric patients aged 2 to <3 years, 28 paediatric patients aged ≥3 to <6 years and 89 paediatric patients aged 6 to ≤12 years across the lenvatinib paediatric program, lenvatinib oral clearance (CL/F) was affected by body weight but not age. Predicted exposure levels in terms of area under the curve at steady-state (AUCss) in paediatric patients receiving 14 mg/m^2 were comparable to those in adult patients receiving a fixed dose of 24 mg. In these studies, there were no apparent differences in the pharmacokinetics of active substance lenvatinib among children (2 – 12 years), adolescents, and young adult patients with studied tumour types, but data in children are relatively limited to draw definite conclusions (see section 4.2).

5.3 Preclinical safety data

In the repeated-dose toxicity studies (up to 39 weeks), lenvatinib caused toxicologic changes in various organs and tissues related to the expected pharmacologic effects of lenvatinib including glomerulopathy, testicular hypocellularity, ovarian follicular atresia, gastrointestinal changes, bone changes, changes to the adrenals (rats and dogs), and arterial (arterial fibrinoid necrosis, medial degeneration, or haemorrhage) lesions in rats, dogs, and cynomolgus monkeys. Elevated transaminase levels asociated with signs of hepatotoxicity, were also observed in rats, dogs and monkeys.
Reversibility of the toxicologic changes was observed at the end of a 4-week recovery period in all animal species investigated.

Genotoxicity

Lenvatinib was not genotoxic.

Carcinogenicity studies have not been conducted with lenvatinib.

Reproductive and developmental toxicity

No specific studies with lenvatinib have been conducted in animals to evaluate the effect on fertility. However, testicular (hypocellularity of the seminiferous epithelium) and ovarian changes (follicular atresia) were observed in repeated-dose toxicity studies in animals at exposures 11 to 15 times (rat) or 0.6 to 7 times (monkey) the anticipated clinical exposure (based on AUC) at the maximum tolerated human dose. These findings were reversible at the end of a 4-week recovery period.

Administration of lenvatinib during organogenesis resulted in embryolethality and teratogenicity in rats (foetal external and skeletal anomalies) at exposures below the clinical exposure (based on AUC) at the maximum tolerated human dose, and rabbits (foetal external, visceral or skeletal anomalies) based on body surface area; mg/m2 at the maximum tolerated human dose. These findings indicate that lenvatinib has a teratogenic potential, likely related to the pharmacologic activity of lenvatinib as an antiangiogenic agent.

Lenvatinib and its metabolites are excreted in rat milk.

Juvenile animal toxicity studies

Mortality was the dose-limiting toxicity in juvenile rats in which dosing was initiated on postnatal day (PND) 7 or PND21 and was observed at exposures that were respectively 125- or 12-fold lower compared with the exposure at which mortality was observed in adult rats, suggesting an increasing sensitivity to toxicity with decreasing age. Therefore, mortality may be attributed to complications related to primary duodenal lesions with possible contribution from additional toxicities in immature target organs.

The toxicity of lenvatinib was more prominent in younger rats (dosing initiated on PND7) compared with those with dosing initiated on PND21 and mortality and some toxicities were observed earlier in the juvenile rats at 10 mg/kg compared with adult rats administered the same dose level. Growth retardation, secondary delay of physical development, and lesions attributable to pharmacologic effects (incisors, femur [epiphyseal growth plate], kidneys, adrenals, and duodenum) were also observed in juvenile rats.

6 PHARMACEUTICAL PARTICULARS

6.1 List of excipients

Capsule content
Sodium hydrogen carbonate
Mannitol

Microcrystalline cellulose
Hydroxypropylcellulose
Low-substituted hydroxypropylcellulose
Talc

Capsule shell
Hypromellose
Black iron oxide (E172)
Yellow iron oxide (E172)
Red iron oxide (E172)
Titanium dioxide

Printing ink
Shellac
Potassium hydroxide
Black iron oxide (E172)

6.2 Incompatibilities

Not applicable.

6.3 Shelf life

2 years

6.4 Special precautions for storage

Store in the original package in order to protect frommoisture.

6.5 Nature and contents of container

Each carton contains 30, 60 or 90 hard capsules in oPA/Al/PVC/Al blisters or 30x1, 60x1 or 90x1 hard capsules in oPA/Al/PVC/Al unit dose blisters.

Each carton contains 30, 60 or 90 hard capsules in oPA/Al/PVC/PE/Al blisters with desiccant or 30x1, 60x1 or 90x1 hard capsules in oPA/Al/PVC/PE/Al unit dose blisters with desiccant.

Not all pack sizes may be marketed.

6.6 Special precautions for disposal and other handling

Caregivers should not open the capsule, in order to avoid repeated exposure to the contents of the capsule.

Any unused medicinal product or waste material should be disposed of in accordance with local requirements.

7 MARKETING AUTHORISATION HOLDER

Viatris Limited
Damastown Industrial Park
Mulhuddart
Dublin 15
DUBLIN
Ireland

8 MARKETING AUTHORISATION NUMBER

PA23266/081/002

9 DATE OF FIRST AUTHORISATION/RENEWAL OF THE AUTHORISATION

Date of first authorisation: 6th July 2026

10 DATE OF REVISION OF THE TEXT